PRINCIPLES AND PRACTICE OF ELEMENTARY DRAWING

MABEL BROWNING SOPER

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A NORMAL SCHOOL TEXT BOOK

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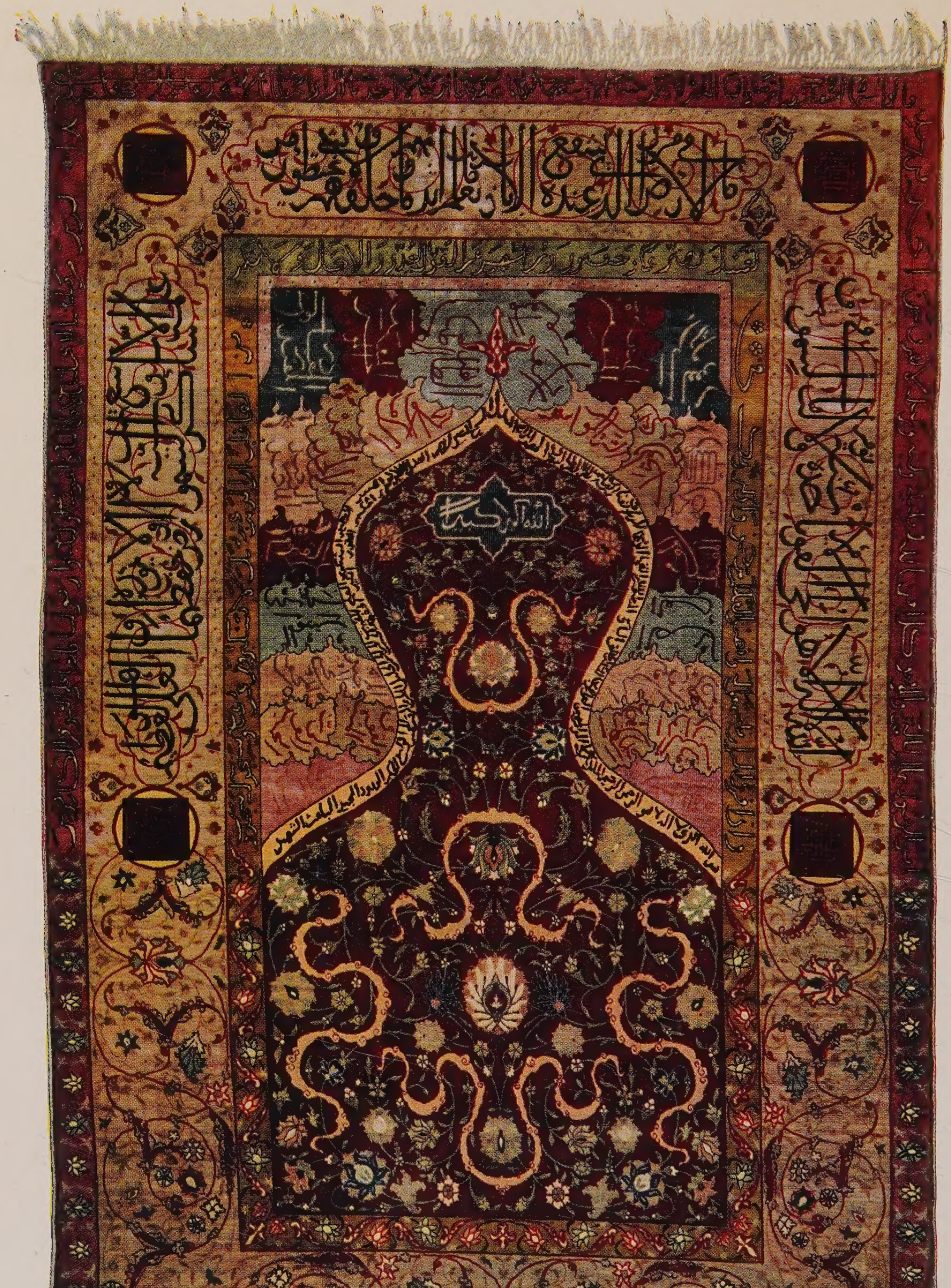

Copy of Frontispiece "Oriental Rugs in the Home"
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PRINCIPLES AND PRACTICE
OF
ELEMENTARY DRAWING

A NORMAL SCHOOL TEXTBOOK

BY

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Method must be used not for its own sake, but for securing better self-expression and more interesting doing.

Every mode of expression, no matter how mechanical, no matter how fantastic, no matter how impressionistic, has these two sides, idea and technique.

We cannot speak of an idea and its expression. The expression is more than a mode of conveying an already formed idea, it is a part of the formation of the idea itself.

We gain ideas and make them truly our own by reproducing them. The image is only in its expression, the expression is only the image moving, vitalizing itself.

—*From an Unpublished Essay* "Imagination and Expression and the Psychology of Drawing," by Dr. John Dewey.

PREFACE

The following text book has been written to meet the difficulties of a definite situation. This has been to prepare six large entering classes of thirty to thirty-five students to teach courses of drawing already established in the elementary public schools. The students enter the work in art from high schools with varied preparation, or none at all; with limited æsthetic appreciation or feeling; and with no knowledge of organized subject-matter.

Usually two forty minute periods a week for from fifty to eighty weeks are given to class instruction and practice, in addition to which home work is required. This text has been used as a basis for class demonstration, instruction by the teacher, and for home study by the pupils.

The first draft of the subject was written on charts before the class, as the presentation and demonstration were made, and is therefore a record of class instruction. It aims to give the students a background of knowledge of the Principles of Drawing through practice, and to prepare them for courses in teaching and in æsthetics, which are given later in connection with the Training School, and the outside schools of practice. Drawing in the Training School is based upon the "project plan" of instruction, and not, as in this text, upon subject-matter.*

It is expected that this text will be supplemented by supervised actual teaching in the grades, by blackboard practice in special classes, by lectures on art subjects, and by study of various courses of Drawing for grade schools.

A list of supplementary material to be used in connection with the book is appended.

The illustrations which appear with the text have been furnished, for the most part, by normal school students, either directly from their drawings, or have been re-drawn by the author. When the principle to be elucidated was not clearly and correctly shown, re-drawing or new drawings were necessary. In some cases where an ideal conception of some style or principle of art was desired, works by professional artists have been introduced, notably in the illustrations of Modes of Drawing, Color Harmonies, and in Lettering by James Hall and Edward Johnston.

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*(A book on ''Drawing and Handwork Projects for Grade Schools'' is now in preparation, which will aim to describe this phase of Art instruction.)

Acknowledgment is made for the assistance received from Mr. James Hall, Prof. Walter Sargent, and from other friends who have given the author the benefit of their experience. In writing the text, reference has also been made to the following publications:

On Drawing and Painting, Denman W. Ross, P.H.D. (Houghton, Mifflin Co.)

Art Education in High Schools. (Prang Educational Co.)

Free-hand Perspective and Sketching, Dora Miriam Norton. (Published by the Author, Brooklyn, N. Y.)

Design in Theory and Practice, Ernest A. Batchelder. (The Macmillan Co.)

Composition, Arthur W. Dow. (Doubleday, Page & Co.)

Writing, Illuminating, and Lettering, Edward Johnston. (The Macmillan Co.)

LIST OF ILLUSTRATIVE SUPPLEMENTARY MATERIAL

Art Course Public Schools of Chicago. (Scott, Foresman and Co.)

The Use of the Plant in Decorative Design, Lawrence and Sheldon. (Scott, Foresman and Co.)

Portfolio Pencil Drawings of Antique Buildings, Jacobs. (Scott, Foresman and Co.)

Portfolio Drawings of Trees, Earl A. Warner. (Scott, Foresman and Co.)

Portfolio Drawings of Trees, Woodbury. (Milton Bradley Co.)

Manual Arts, Loose-Leaf Portfolios. (Prang Co.)

Applied Arts Drawing Books. (Atkinson, Mentzer Co.)

Picture Building with Cut-Outs, Soper. (Milton Bradley Co.)

Drawing and Constructive Work, Collins. (Scribner Co.)

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INTRODUCTION

The following set of directions is given to form an intellectual basis for the study of drawing on its technical, formal side, in order that the teacher may have an acquaintance with "art structure" and a working knowledge of the fundamental principles, which she needs to direct the work of children.

For those who like drawing and have a natural aptitude or talent for it, and for those *who have had good training in it*, many of the directions may seem unnecessary, and will be, therefore, a review of the subject. Those who think they have an inherited or a traditional dislike for it, or have no ability or previous training, may, by carefully following these directions, be convinced that they can at least become good critics and supervisors of children's work. They can also develop in themselves a refined and cultivated taste, which will result in orderly, neat, well arranged school work; in an improved personal appearance; and in more artistic and orderly surroundings. They can attain also some facility in the technique of drawing.

It is fully realized that the soul and spirit of all real, artistic production associated with drawing cannot be conveyed in any form of written directions, but must be worked out by each individual according to his interpretation of those higher principles of æsthetic appreciation.

Drawing, like the English language, has both its formal and its interpretive side, and, as has been stated, its formal side is presented here. The success of a teacher in this subject largely depends upon the enthusiasm, love, and interest that she can arouse for it in her pupils' minds.

Since the purpose of drawing in the public schools is not primarily that of training pupils to become artists, it is necessary that those larger purposes for which it exists should be clearly understood. Many of these are common to all subjects—development of observation, appreciation, and the like; others are distinctly related to this subject alone, such as the following:—

I. Development of definite *sense perception* of—
  1. *Color;* in order to be able to distinguish, select, reproduce, and combine colors harmoniously.
  2. *Direction;* to learn to perceive relative directions of lines, sizes of angles, and beauty of movement and action.
  3. *Proportion;* to be able to distinguish relative sizes of surfaces and objects.
  4. *Form;* to distinguish and reproduce shapes.

II. Use—
  1. To record a fact, enabling one to interpret environment.
  2. To express an idea incomplete with words only.
  3. To make a picture, *i.e.*, group a series of ideas according to laws of composition.
  4. To make a pattern or design applicable as decoration according to laws of order and beauty.

In teaching the subject there are many methods and limitless applications of these methods which are often controlled by local conditions. These are used in order to develop this æsthetic sense; but all the various exercises and practices in use in public schools may be grouped under the following subjects:

I. Color.

II. Representation.
  1. Nature (Plant) drawing.
  2. Animal and "Pose" drawing.
  3. Object drawing, including composition and perspective.

III. Design, including picture study and lettering.

IV. Mechanical drawing, including maps, diagrams, and "working drawings."

In the following exercises, two sets of drawings are required, one, to illustrate "method," and to be drawn on note book size paper, for the so-called "Methods Note or Plan Book" to be called "Methods Note Book Drawings"; the other set to be drawn carefully on larger paper, mounted on loose sheets and placed in a Portfolio, to be called "Portfolio Drawings."

DESIGN

The term "design" used in its specific sense, has four forms or methods of application:

1. Pattern—used in ornament, textiles, etc.
2. Decoration—used in interior decoration, dress designs, etc.
3. Construction—used in making forms such as baskets, pottery, furniture, houses, etc.
4. Composition—
    (1) Used in making pictures (sometimes called "Pictorial Design.")
    (2) Used in making sculptured forms or modeling.

Therefore design is the basis of all art expression.

There are certain principles of order which underlie all these forms of design. When there is no order or beauty in any pattern, decoration, or construction, there is no design. A collection of drawings representing different objects, which may suggest the elements used in some story, such as trees, people, sky, and hills scattered over the surface of a paper, never make a picture any more than a collection of disconnected words makes a sentence. This is because there is no arrangement of elements according to laws which govern picture construction. The same may be true in regard to pattern, decoration, or other forms of design. A collection of spots or lines, or flower forms, scattered upon the surface of a paper, never produces pattern, until there appear in their arrangement some definite connection and order. A vase, without rhythmic relation of line and area, is not a good design. A miscellaneous collection of articles in a room, on a table or a shelf, if not arranged with some regard to order, will produce inharmony and disorder, and therefore lack beauty and design.

In describing the principles which underlie design, certain terms are used and certain conventions employed which belong to this form of expression. These may be learned, as other forms of technical language are learned, and must be understood through their application.

PRINCIPLES

I. BALANCE.

1. The equilibrium of a pattern, picture, or decoration must be sustained.

This principle is called balance.

The equilibrium may be sustained by a symmetrical or by an unsymmetrical arrangement of elements, but the balance must be kept. The subject of the pattern or composition may be balanced by a blank area. The effect produced must not be one-sided, top-heavy, or attract the eye more to one corner or side than to the other.

II. RHYTHM.

There must be consistent movement throughout a pattern, picture, or decoration so that the eye can follow the design. This movement must be consistent and must have accent, in order that the relation between the elements may be sustained.

This principle is called rhythm.

The simplest form of rhythm is repetition of elements in a design. This repetition may be regular, having equal measures in a sequence, or the sequence may be maintained by the repetition of unequal measures. Rhythm is produced sometimes by movement of line, sometimes by right relation of areas; then the feeling of movement in the elements, the relation of their proportions and shapes, is said to be rhythmic.

III. UNITY.

The effect of the whole design must be a harmonious unit. Each part must be related to the whole so that the impression received is definite and consistent. A single dominating element must determine the character of the design, and the other elements must be subordinate to it.

This principle is called Unity or Harmony.

It is difficult, if not impossible, to produce harmony with unrelated, inconsistent elements. A room, which contains articles unrelated in form, color, or use is never orderly or harmonious, because it lacks this principle of beauty.

Elements which are unlike and unrelated, when isolated, may be unified by some element, as an inclosing form, etc., which has a quality common to both. That is, unrelated elements may be related and produce a harmonious design by the introduction of a new element which harmonizes with both of them.

IV. DOMINANCE.

A single dominating element must determine the character of the design.

This principle is called Dominance.

Every pattern or picture must have a certain part or element, which makes a center of attraction or interest. The placing of this *attraction* and the relation of the surrounding areas and elements to it determine its beauty and often constitute the center upon and around which a design is developed.

V. SUBORDINATION.

All other elements must be subordinate in attraction to the dominating element.

This principle is called Subordination.

These subordinate elements in a design are often echoes in form and interest of the dominating element. They make a design interesting, fill the surrounding areas, and assist in developing the principles of balance and rhythm, but they should never dominate the design.

I. PURE DESIGN

In so-called Pure Design, abstract elements, such as lines, dots, spots of different shapes and measures are used. Since these elements in themselves have little interest, the beauty of the design largely depends upon their arrangement according to laws of order, that is, principles of good design: balance, subordination, rhythm, unity, symmetry, etc. The application of one of these principles may be more emphatic in some design, and therefore more noticeable, but all of these principles are embodied in every good design.

Pure Design is one of the easiest forms of design, because the elements in themselves are consistent.

DIRECTIONS FOR DESIGNING STRIPE PATTERNS WITH LINES

Draw a rectangle of good proportions or cut paper this shape. With brush and ink, or color, design a stripe pattern across the paper at top and bottom of rectangle, like stripes upon a rug or blanket. Consider the widths of the lines and the widths of spaces between the lines. Vary them, but maintain rhythmic relations between them so that unity is preserved. Avoid monotonous, commonplace results. Consider the effect of balance made by the arrangement of lines and areas, and maintain good proportions in the pattern as a whole, *i. e.*, the rectangle and the stripes upon it. Do not place the stripe too near the top or bottom of the rectangle, but leave margins.

For fine lines, hold the brush in a vertical position; for broad lines, hold it flat and slanted in the direction of the line. Use a slow, even, pressure upon the paper and draw the line with one stroke of the brush.

EXERCISE

Stripe Pattern with Lines

Methods Note Book

1. Three stripe patterns in ink.
    (1) Using three lines in a rhythm.
    (2) Using five lines in a rhythm.
    (3) Using seven lines in a rhythm.

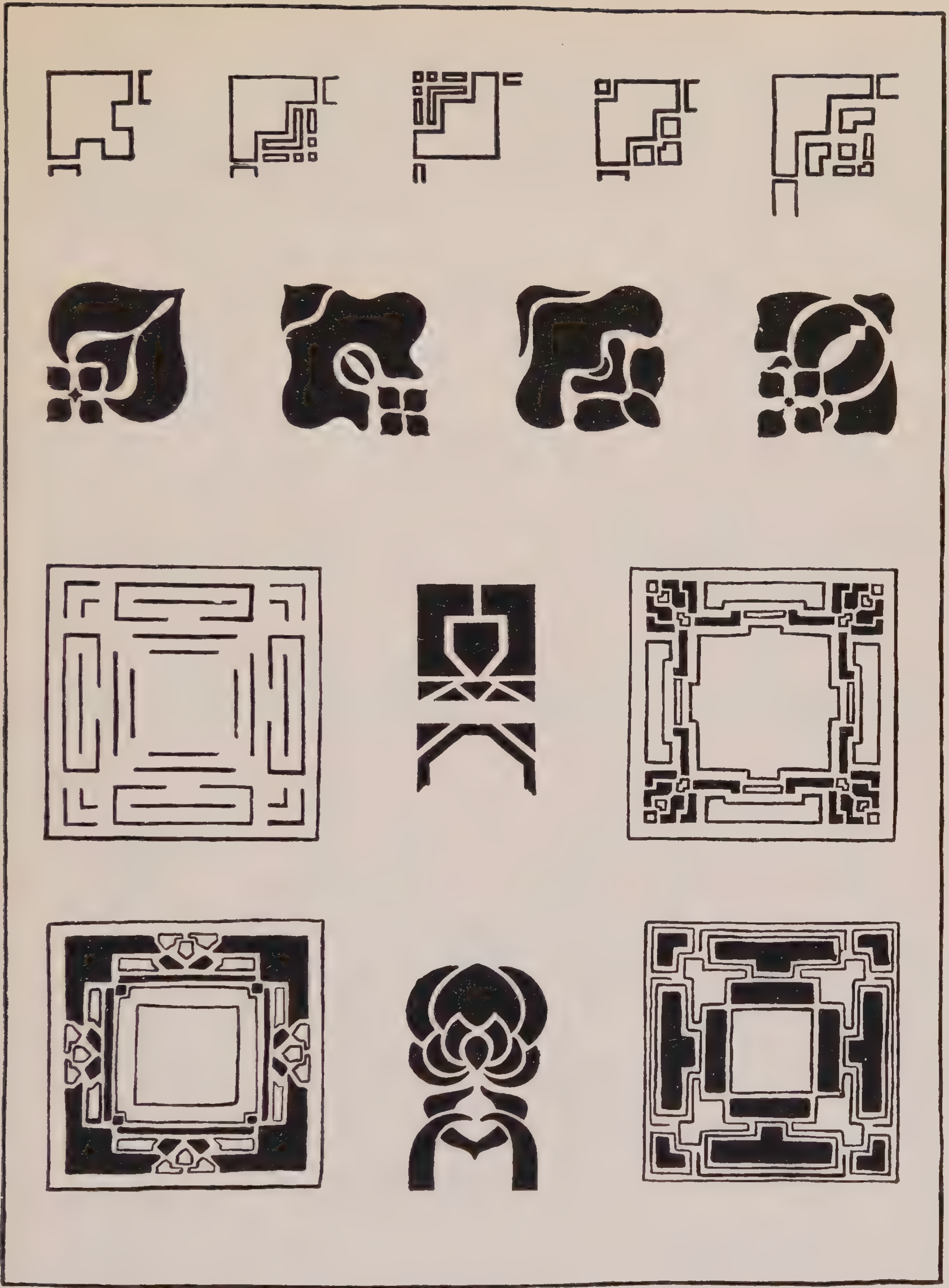


PLATE 1. CUT AREAS

2. Same on colored paper in color.

3. Same on checked paper in crayons—for rug weaving, plain over-one-and-under-one weaving. Use vertical strokes to simulate the weave of a rug, and make the central area a solid color.

DIRECTIONS FOR LINE AND SPOT (FIGURE) PATTERNS

I. In a Border. Place tracing paper over an "underlay" of checked paper. Draw border lines with brush. Within the lines drawn, arrange repeats with:

1. Rhythmic lines and spaces, painted directly upon the paper.
2. Rhythmic lines and dots.
3. Rhythmic lines, spots, or shapes, painted directly upon the paper.

Notice the change in rhythm produced by equal and unequal measures; by repetition at regular intervals; by repetition at irregular intervals.

II. Over a Surface. Place tracing paper over an underlay of checked paper. Design several units directly with the brush, using lines, dots, and shapes in combination. Choose the best and repeat over a surface in:

1. Even vertical lines (stripes).
2. Alternating lines and spaces.
3. Diagonal lines.

Notice the change in rhythm produced by change in arrangement and spacing.

III. In a Border for Textile Weaving. Checked Paper and One Color Crayon. (Same may be used for *sewed* baskets.) Make a pattern of repeated units for a woven border.

Consider that each check of the paper represents three warp threads of the material. Draw these in vertical lines with black lead pencil. Draw the pattern in crayon, using horizontal lines to represent the woof; therefore three horizontal lines over three vertical lines represent one check of the paper and one woof thread in the design. Remember that in weaving a pattern the weaver or woof thread goes under and over the warp threads, so in a design to be woven, avoid carrying the weaver over too many warp threads, which would make the woof too loose;

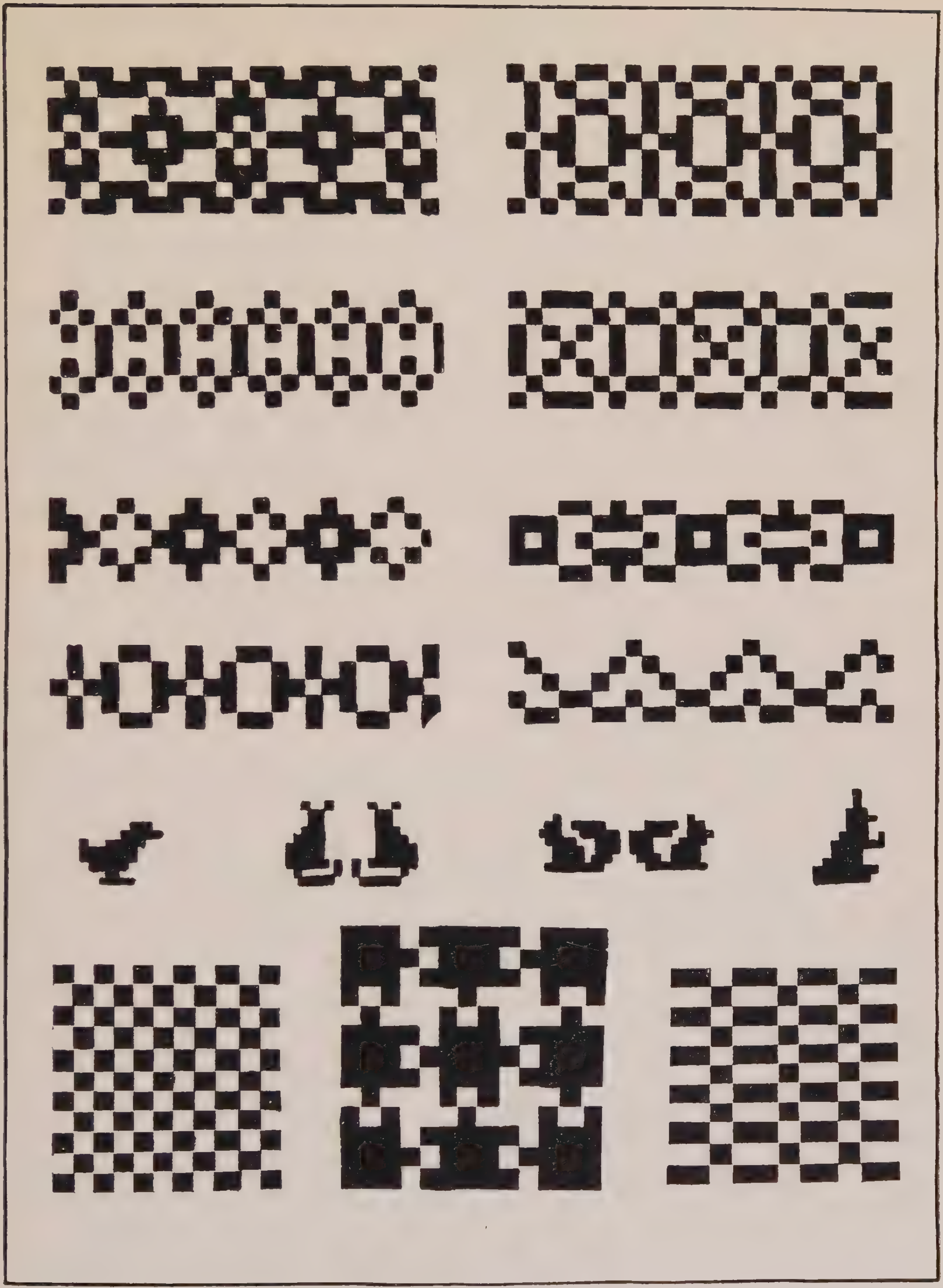


Plate 2. Weaving Patterns

avoid also loose warp threads, by repeating the same arrangement of stitches in each row, one below the other.

Consider the dominating interest in the design by concentrating stitches and spaces. Avoid monotonous and scattered effects, such as produced by over-one-and-under-one in alternate rows.

Method I. Design a unit and then repeat it at regular intervals in a border; connect the repeated units by another, which fills the intervening space.

Method II. Design in rows. When the pattern is bi-symmetric, *i.e.*, balanced on a horizontal diameter, begin with the center of the design and repeat each row both above and below the center row. When the pattern is one with a "zigzag" begin with the top or bottom row. (See Plate 2.)

EXERCISES

Woven Patterns in Borders

Methods Note Book

I. Design weaving patterns on checked paper.
    1. Patterns with three rows.
    2. Patterns with five rows.
    3. Patterns with seven rows.
    4. Patterns with any number of rows.

Directions for Dividing Area Patterns

Corrections and variations of the first design may be made on tracing paper placed over the original arrangement.

I. Pattern in a square, balanced on a diagonal. (See Plate 3.)
    1. Draw a two-inch square.
    2. Draw its diagonal.
    3. Draw on each side of diagonal on the edge of the square, a small square in good rhythmic relation to the larger square (not too small nor too large). Notice that the effect is a design balanced on the diagonal; one large area dominates the design. Reline the edge with the squares taken out to show the figure more plainly. Plate 1. Fig. 1.
    4. Keep this design as a basic motive and vary it by changing the proportions of the small areas. Notice the effect in dominance produced by the changes.

5. Using the same motive, change by adding small squares grouped to balance the large plain corner area. Keep the design balanced on the diagonal. Notice that the group of small areas is more attractive than the large area, and is therefore the dominating element in the design.
6. Using the same design as number 5, change it by adding small area in corner of large area. Notice that interest is now divided between the group of areas and the small one in the corner, and that the large central area is the attraction.

The above designs may be developed into so-called "Strap and Corner" patterns for book-covers, title-pages, etc., by repeating the square units in corners and connecting them with straight lines or bands consistently related in measure to the corner areas. The whole design, with its four corners and bands, must be consistent, a unit with its corner units facing toward the center diameter. (See Plate 3.)

Other arrangements of the square unit may be made, such as a repeat in a border across the top, around the edge, etc.

II. Pattern in a square balanced on the diameters. (See Plate 1.)

1. Draw a square.
2. Draw its diameters.
3. Locate the attraction in the center. (Draw a square in the center in good rhythmic relation to the large square.)
4. Subdivide this central area into a group of small areas.
5. Divide the surrounding areas (corners) into harmonious shapes of subordinate interest.

This design may be developed into borders, etc., by repetition of this unit.

III. Pattern in a rectangle balanced on a diameter. (See Plate 3.)

(a) 1. Draw a rectangle of good proportions, horizontal or [vertical.
2. Draw its vertical diameter.
3. Locate the attraction above or below the center on the diameter.
4. Subdivide this area (center of attraction) into a group of small areas.
5. Divide the surrounding area into harmonious shapes of subordinate interests.

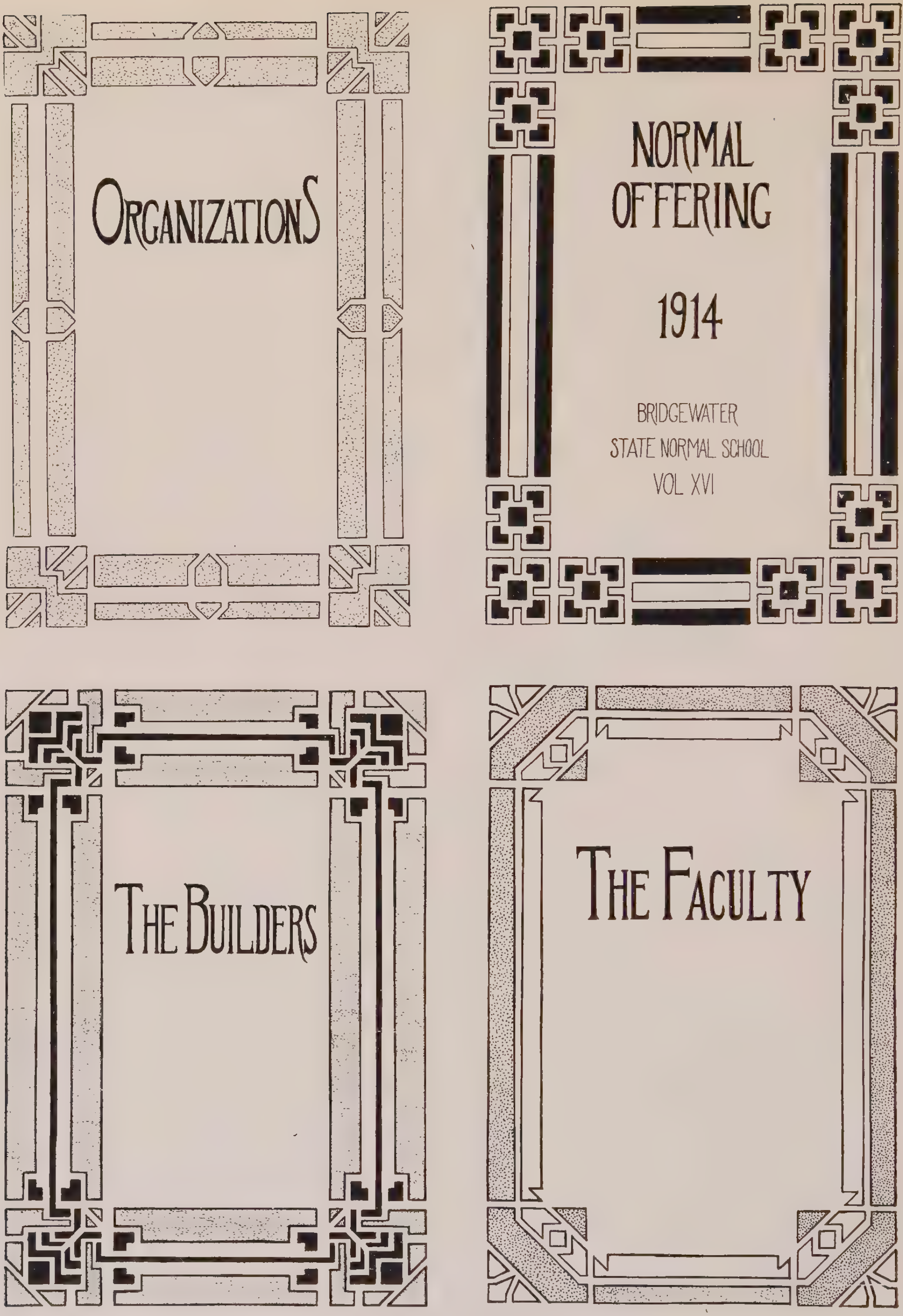


PLATE 3. Book Cover Designs

(b) Repeat the above, omitting number 4, *i. e.*, leave the central attraction plain, and subdivide the surrounding area only.

IV. Use same arrangement of areas and redraw them. Use tracing paper over the original arrangement. Variations may be made by redrawing in curved lines. (See Plate 1.)

EXERCISES

Cut-Area Patterns

Methods Note Book

I. Design a two-inch square in straight line areas. Draw in light lines. Reline result lines:

1. One large area with two small areas. Balance on diagonal.
2. One large area with group of small areas. Balance on diagonal.
3. One large area with group of small and one small area. Balance on diagonal.
4. Original arrangement of areas within a square.

Select any one of the above and redraw in curved lines.

II. Design a square in straight-line areas, balanced on the diameters with:

1. Interest in the center.
2. Interest in the center of the sides.
3. Interest in the corners.

III. Design a rectangle in straight-line areas, balanced on the vertical diameter.

IV. Design same as number III, balanced on the horizontal diameter. Select any of the above and redraw in curved lines.

Portfolio Drawings

Instead of the portfolio drawings, direct application of any of the Methods Note Book designs may be used in one or more of the following:

1. Portfolio covers, stenciled or block printed in crayon or water color.
2. Book covers.
3. Title pages for "Normal Offering" or other school magazine, size 6¼″ x 9½″.
4. Blotter ends.
5. Blotter corners.
6. Address books.
7. Stenciled bags, sofa cushions, etc.
8. Posters.
9. Christmas texts.
10. Sachet envelopes.

II. PLANT FORMS IN DESIGN

There are three ways in which plant drawing is used in design: Decorative Arrangement, Natural Design, and Conventional Design.

Decorative Arrangement

Directions for using plant drawings in Decorative Arrangement.

Enclose a nature drawing, as made from the plant, in a frame made by lines, or select a part of the drawing and enclose it according to the following rules: (See Plate 4.)

1. The leaves, stems, etc., should divide the large enclosed area made by the frame lines into smaller areas of contrasting sizes and shapes.
2. The axis of the spray should be in harmony with axis of frame.
3. The most interesting part of the spray (flowers, berries, groups of leaves) should be near the center of the area unless balanced by properly related spaces or subordinate interests.
4. Subordinate interests may occupy other positions to give balance, contrast, and good space relations.

Avoid the following: (1) A small spray in a large area which it would not divide and therefore could not make a design. (2) Stem starting from a corner and ending in a corner of the frame. (3) An equal division of the enclosed area by a stem through the center. (4) Interesting parts of spray placed near the edge or in the corner of the frame. (5) Parts of spray (leaves, berries, etc.) just touching the frame-lines or resting upon them. (6) Crossed stems.

EXERCISES

Decorative Arrangement

Methods Note Book

1. Cut a "finder" from a piece of paper by making two right angles, 6 and 9 inches for sides, and ½ inch wide. Place these about a drawing done from nature, adjusting them in order to find the best arrangement according to laws given above. Draw a frame line around this part. Cut and mount on paper. Allow margins of appropriate widths in mounting paper.
2. Repeat 1. Instead of cutting out the arrangement selected, place tracing paper over it and trace the drawing. Draw frame lines around the design in an appropriate color, if color has been used in the tracing.

Portfolio Drawing

Apply to Calendar Decoration.

Apply to Christmas Text or Verse.

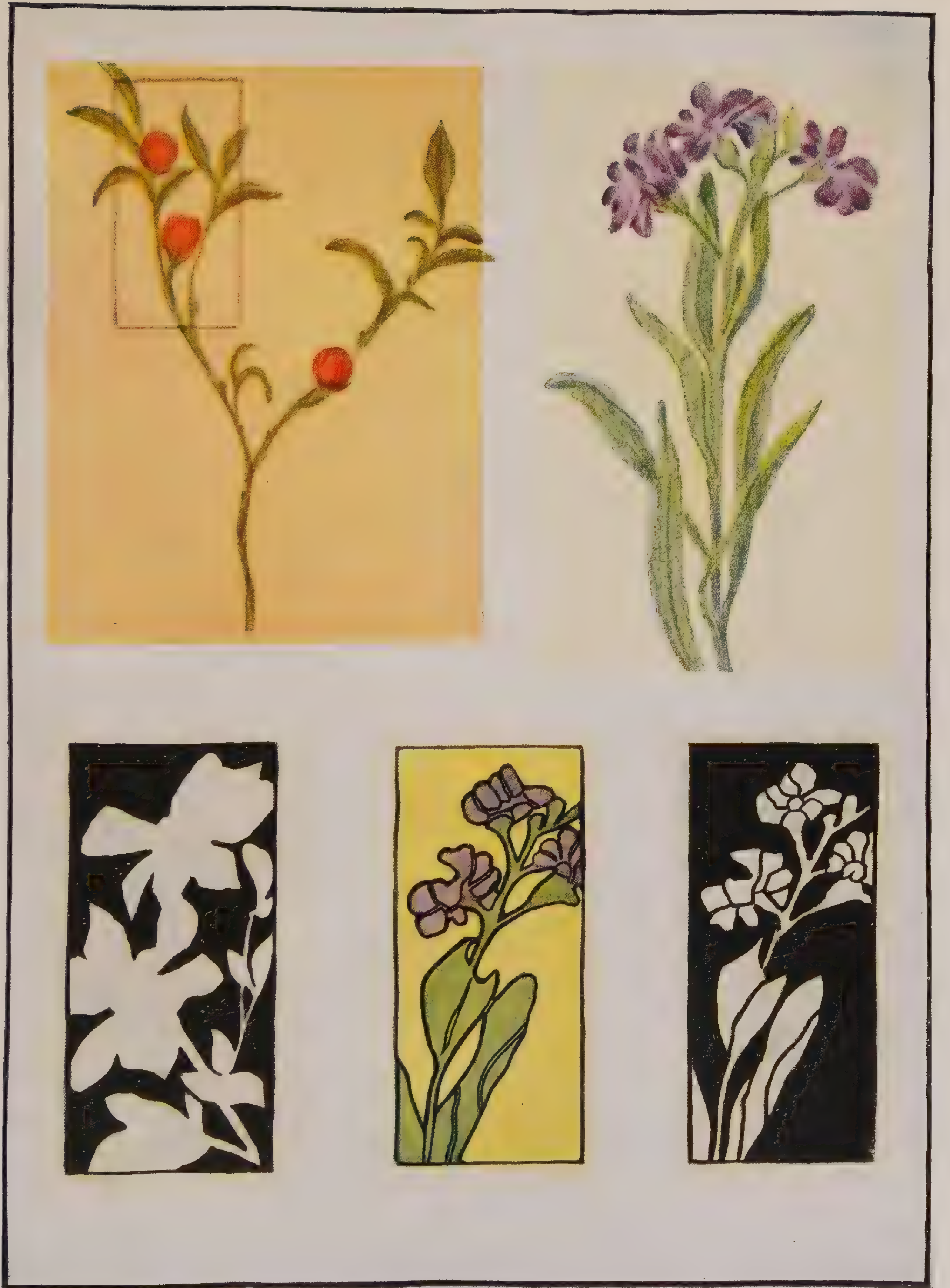


PLATE 4. Decorative Arrangement and Natural Design

III. NATURAL DESIGN

Decorative arrangement may become more abstract, *i. e.*, less realistic, by redrawing the original drawing done from the plant, and so arranging and rearranging the parts that the enclosing area is well filled and balanced. The background, as well as the forms drawn upon it, now becomes a pattern, and the result should be better design. (See Plate 4 and Plates 13 and 15.)

The laws of natural growth are not ignored, but may be slightly varied.

The same rules are followed as in "decorative arrangement," *i. e.*:

1. Division of area.
2. Placing of the interest.
3. Placing the subordinate interests.
4. Balance.
5. Rhythm.
6. Unity or Harmony.
7. Filling the area with pattern made by background and by the forms of the subject.

EXERCISES

Natural Design

Methods Note Book

1. Design an oblong the desired proportions for application to a text, Christmas card, or announcement. In this oblong draw from some nature-motive, or plant form according to laws given above. Place tracing paper over the design and make three tracings.

(1) On one tracing, paint the background black and leave the plant forms solid white with no inside lines. (See Plate 4.)

(2) On second tracing, paint the design, including background and plant forms upon the background, in three colors (three closely related hues, different intensities, same value).

(3) On third tracing, repeat in a different color combination suggested by the natural coloring of the plant used in the design. Plate 4.

(4) Take one of the designs made and place an initial letter in an appropriate place in the design, according to laws of balance.

Portfolio Drawings

1. Apply to decoration of Text.
2. Apply to decoration of Calendar.
3. Apply to decorative heading for title page of booklet.

IV. CONVENTIONAL DESIGN

In conventionalized design (from nature) realistic details are eliminated to a greater or less extent, natural forms being merely suggested. There are two methods used in conventionalizing nature forms:

Method I. The design must first be constructed in lines and areas according to the rules of rhythm and balance, to meet the requirements of the problem or of the object upon which the design is to appear. Then the natural forms must be selected and adapted to conform to the line and area pattern made; therefore conventionalize according to the following rules:

1. Select a geometric shape best adapted to the requirements of the problem, as a square, oblong, triangle, circle, oval, etc., or select an irregular shape in harmony with the form of the object to be decorated.
2. Divide the shape selected by lines in harmony with its outline.
3. Redraw these shapes to resemble natural forms or into these spaces fit shapes resembling natural forms.
4. Refine the forms drawn.
5. Emphasize the rhythm of the pattern by lines or accented shapes.

Method II. Conventionalize according to the following rules:

1. Select some nature specimen which is suitable for the purpose of design.
2. Draw it in several positions to obtain good working material from which to draw the design.
3. Place tracing paper over form drawn and simplify the drawing by separating (turning into separate spots or shapes) its various parts, or redraw over an underlay of finely checked paper.
4. Consider (1) what geometric form the parts most resemble and redraw them to fit into the shape selected. The parts now may only slightly resemble the original form, as their proportions and shapes may have been changed. The areas made should conform to laws of balance, rhythm, and unity. The parts may now be "connected" again or left as separate areas. Or (2) cut out of paper with scissors, shapes resembling natural forms. (See Plate 5.)

The result of either method may be a complete design, as one for a book rack end, paper cutter handle, etc., or may be a unit only. If a unit, it may be repeated in a border or over a surface, and used for borders for cards, book covers, or surface patterns, or for stenciling, block printing, etc. (See Plate 6.)

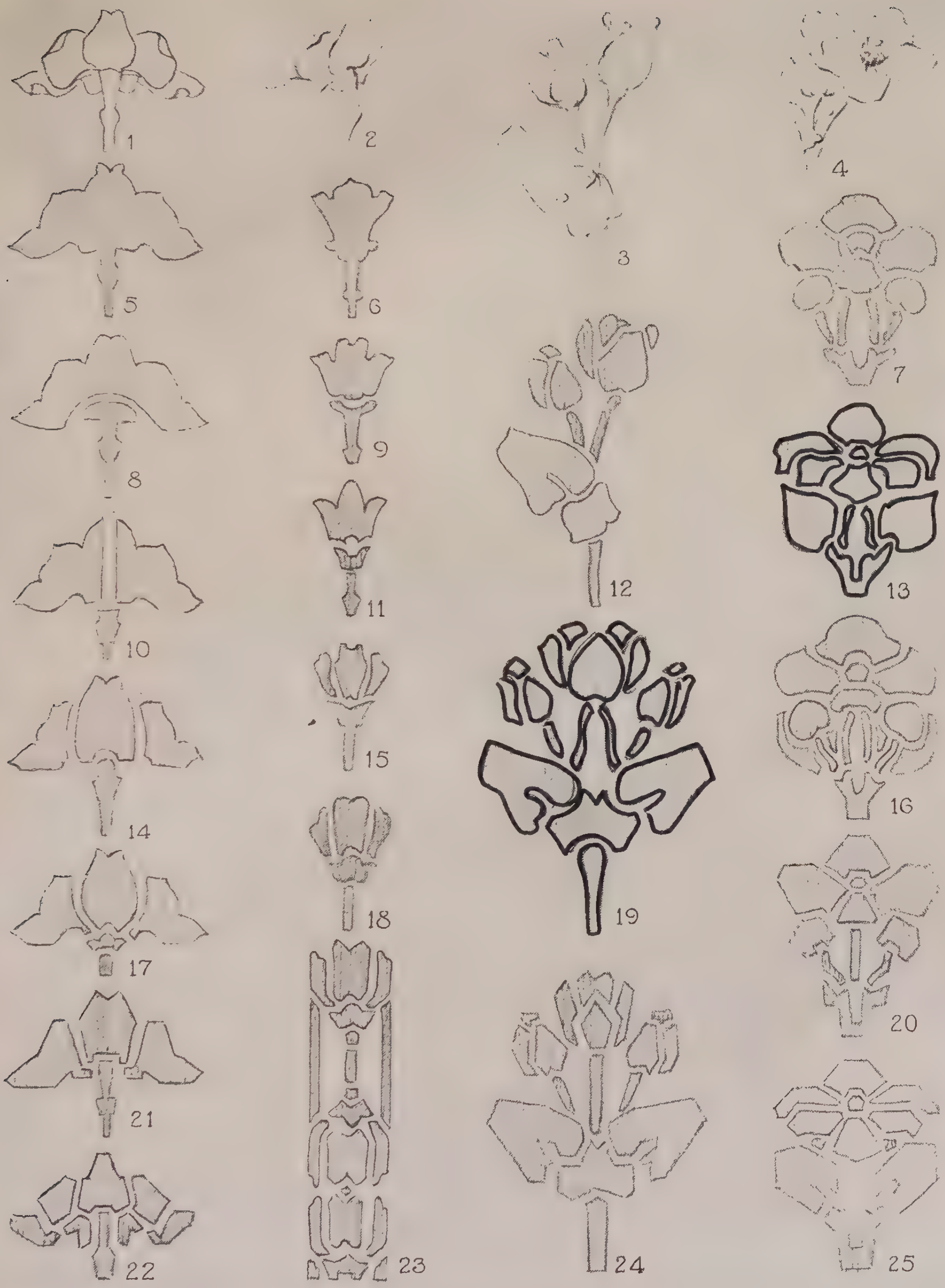


PLATE 5.

CONVENTIONALIZED UNITS
From *The Use of the Plant in Decorative Design for the Grades*
SCOTT, FORESMAN & COMPANY

EXERCISES

Conventionalized Nature Design

Methods Note Book

I. Design a border for a title-page by first method, using conventionalized forms resembling nature. The border may be:

1. Balanced on the diameters, all four corners alike.

2. On the diagonals, with all four corners alike or the opposite corners alike.

3. Made up of units that repeat at equal distances.

II. The border may be across the top and bottom only. Panels thus made may be connected with lines.

III. Design a unit for an all-over pattern by the second method. Use one of the plant drawings made from nature. Use for block-printing or stenciling.

Portfolio Drawing

1. Apply as decoration of Book Rack ends.
2. Apply as decoration of Electric Light Shades.
3. Apply as decoration of Tiles.

V. HISTORIC ORNAMENT

In historic ornament or designs, which have been named after the people who have developed them, various elements, natural, conventionalized, and abstract (or geometric)are the bases of the patterns made.

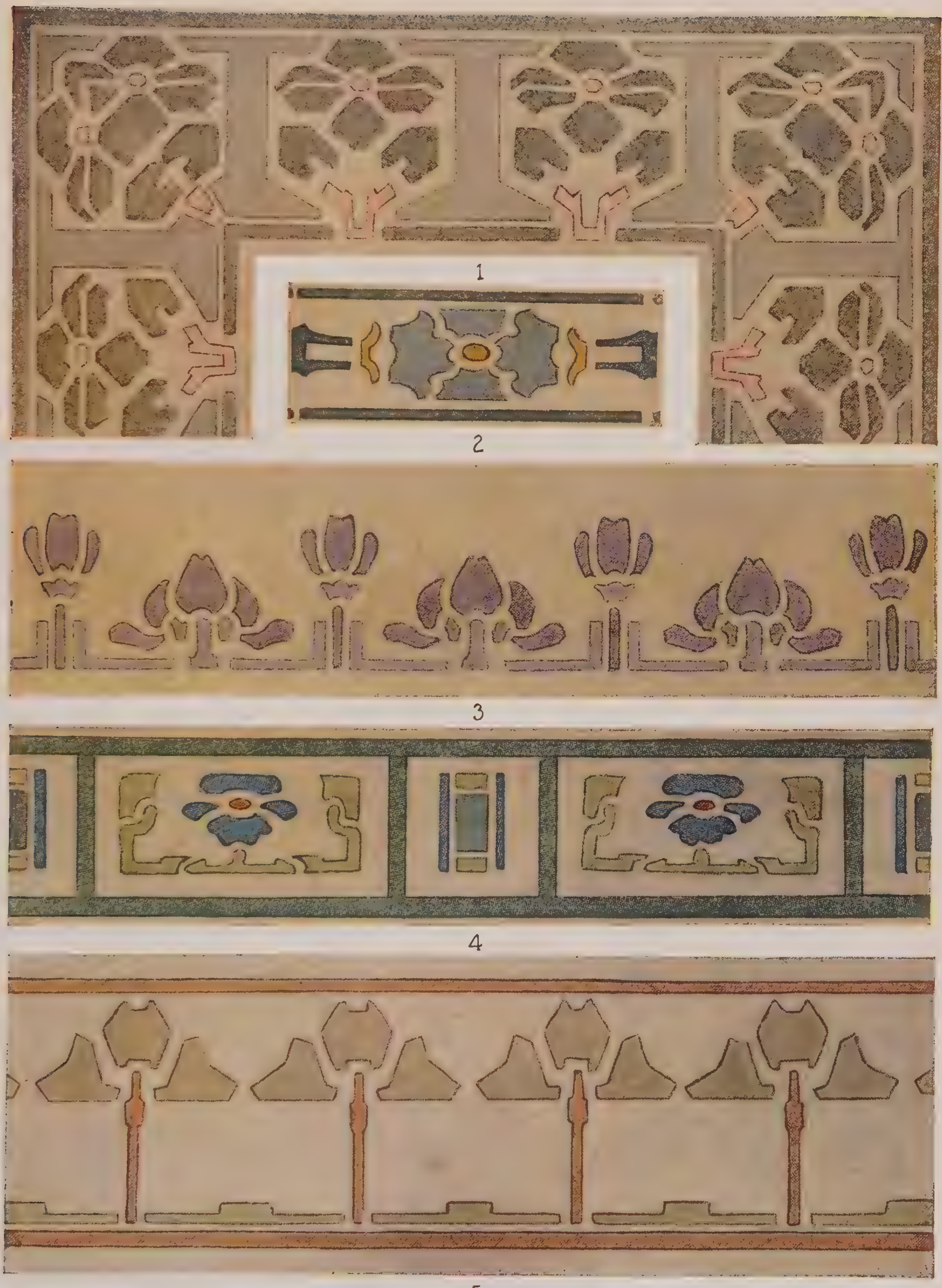
Their interest and beauty depend upon—

1. Their adaptation to the requirements of the thing decorated.
2. The conformity of their elements to the laws of good design.
3. Interest in the symbolism embodied in the design.

When these requirements have been met and persistently maintained the result has been the creation of a "style." The principal styles are—(1) Barbaric or Savage (including the American Indians); (2) Egyptian; (3) Coptic; (4) Greek; (5) Roman; (6) Byzantine; (7) Saracenic; (8) Gothic; (9) Renaissance; (10) Oriental (including Japanese, Chinese, Indian). (See supplementary illustrations.) These styles still influence modern ornament, and some knowledge of them is necessary to an appreciation of good design.

EXERCISE

Copy and trace ornaments to illustrate history note books.


1

2

3

4

5

PLATE 6.

CONVENTIONALIZED BORDERS
From *The Use of the Plant in Decorative Design for the Grades*
SCOTT, FORESMAN & COMPANY

13108

LETTERING

The ability to print well and easily is a most useful accomplishment, as lettering is used in many forms of school work, such as labels for drawings, maps, books, and pictures; booklet titles, notices, posters, texts, programs, etc. Script should never be used for these purposes, and should never appear on the front of a drawing.

The plain Gothic alphabet is the basis of all forms of printed letters and is always in good taste. It is the best form for simple lettering, such as labels and descriptive texts for science drawings, etc., Plate 7.

It is well to learn from a good copy this style of lettering, both in its upper and lower case form, and then to become familiar with other styles which are derived from it, but do not attempt to design letters.

Be careful to keep to a uniform style and type. Never print on the edge of the paper, lines of a diagram or map, or upon margin lines.

THE GOTHIC ALPHABET

I. Characteristics.

1. NORMAL LETTERS.

There are certain letters in the capital form of the alphabet called "normal letters." These are of the same proportion, the width being usually two-thirds of the height. For specific purposes this proportion varies greatly, but whatever the proportion used the following letters must conform to it:—

E, F, H, J, L, N, T, U, Y, Z

2. VARIATION FROM NORMAL LETTERS.

Some letters, in order to satisfy the eye and look the same size as the other letters, vary from this proportion, as the following:—

(1) Round letters are slightly larger.

STUDENTS LIBRARY
CONCORDIA TEACHERS COLLEGE
RIVER FOREST, ILLINOIS

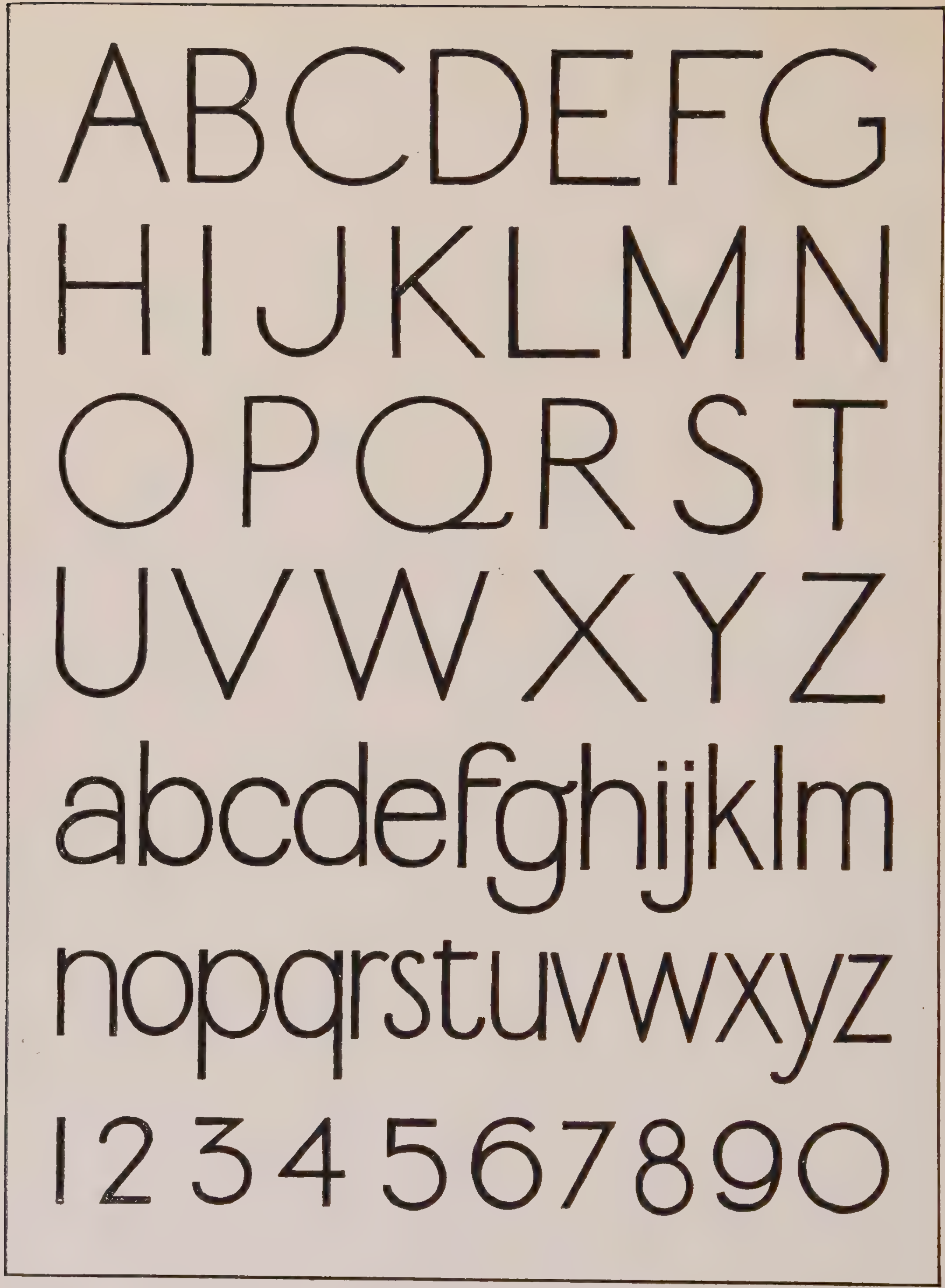


PLATE 7.

ALPHABET
By James Hall

(2) Slanting line letters are wider, and slightly longer, at the point, as A and V. M and W are much wider.

3. PECULIARITIES OF SPECIAL LETTERS.

(1) B, the upper lobe is smaller.

(2) E, the upper horizontal line shorter than the lower.

(3) K and R, lower leg is longer and slants from upper leg or lobe and not from the vertical line.

(4) M has two vertical and two slanting lines, not four slanting lines.

4. IN LOWER-CASE LETTERS all forms are full and round, and the straight lines are tangent to the round part. They are usually two-thirds as high as capitals; the ascending letters are the height of the capitals, the descending letters extend an equal distance below the line.

5. SPACING BETWEEN LETTERS.

(1) Correct spacing depends upon obtaining an equal effect of dark and light made by paper and letters. There should be no gaps in the lettering.

(2) Letters in words should be close together in order that the words may stand out as wholes and not as if made up of separate letters. A slight variation of this rule is made under certain conditions, where other space relations influence the design.

(3) When two verticals occur together in a word the space between them is slightly larger.

(4) When round letters occur next to one another or next to verticals the space is smaller.

(5) Slanting line letters are nearer the adjacent letters at the ends of the slant.

(6) L, T, and I require special consideration and closer spacing.

II. To draw letters for labeling.

Size for large capitals, 3/16 of an inch; for small capitals and lower-case letters, ⅛ of an inch. Words may be made wholly of capitals or of a capital and lower-case letters.

1. Draw light guide lines the width indicated above. Between the lines print the letters.
2. Space letters by *sketching in* very lightly the entire line or title.
3. When correctly spaced draw in the letters with a single line, considering the proper form of each letter. Draw the verticals first, then the horizontals and curves. In W and M draw the parallel lines first. When double line or thick and thin strokes are to be used, go over the letters thickening the proper lines.
4. Erase with a "kneaded eraser."
5. *Reline* with a sharp pointed pencil or pen and ink.

III. To draw titles for booklets, posters, working-drawings, etc.

1. Sketch free-hand oblongs in position for words of title, estimating the proportions according to the number and sizes of letters in the words and the space to be occupied by the title; the proportion is governed by the subject-matter, *i. e.*, the words, the space to be filled, and the placing of the emphasis. As a general rule the most important part of the title should have the largest letters, the least important the smallest. The effect should be a well-balanced design in harmony with the space in which the title appears (see directions on *Pure Design*). (See Plate 9.)
2. Sketch letters of words into the oblongs designed for them. Be sure that the letters fill the entire space of the oblong as drawn.
3. Draw in letters as directed for labeling.

IV. To label science charts, maps, etc.

1. Plan as above the proper position and proportion for titles, descriptive texts, etc. Keep all reading matter in a horizontal position when possible.
2. Print against a straight-edge ruler or paper instead of between guide lines.
3. Use all capital forms for important titles; use lower-case forms for explanations, sub-titles, etc.

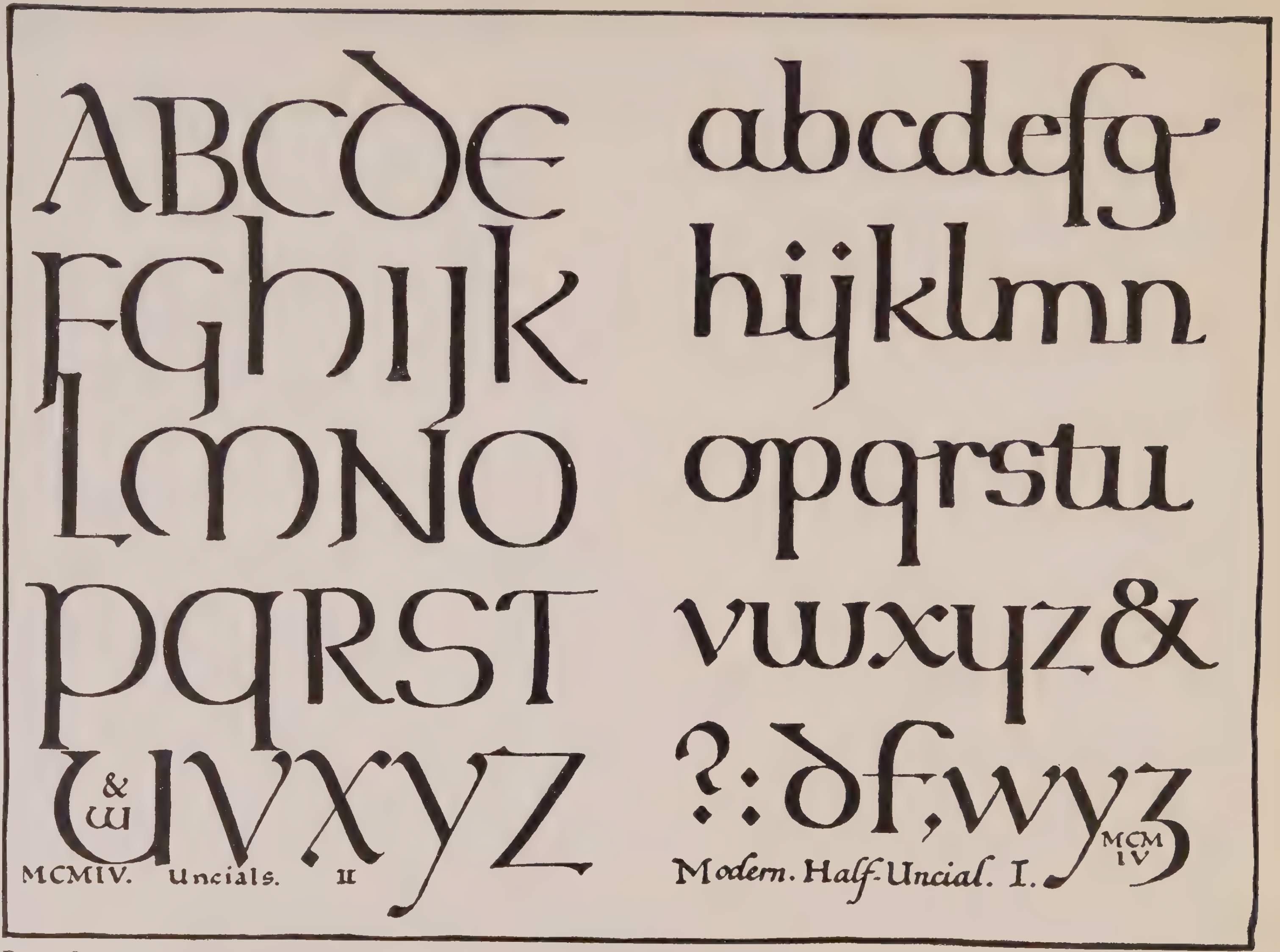


PLATE 8.

MANUSCRIPT WRITING AND LETTERING
By Edward Johnston
Permission of *The Macmillan Company*

MANUSCRIPT WRITING

This form of lettering is used for decorative purposes, and long, descriptive texts. It is the form once used for book-making before the introduction of the printing press. It must be done with a pen, as in ordinary writing, without any sketching-in with a pencil. The pen used must be a quill or reed cut a certain shape, or a special Soennecken writing pen, which gives the stroke of the varied widths desired. The pen is held with its *slanting nib* in a *horizontal* position for a (1) heavy vertical stroke, for a (2) thin horizontal stroke, and for (3) curved strokes; held obliquely for thick and thin slanting strokes. The pen should not be turned while writing. (See Plate 8.)

Characteristics.

1. The forms of the letters are round.
2. The letters are made with thin and thick strokes.
3. All letters of the words are *joined* wherever possible. When this cannot be done naturally, it is done by a connecting curve or "tail."

For strokes, forms, and further directions see given copy and textbook on the subject. *Writing, Illuminating and Lettering*, by Edward Johnston. Published by the Macmillan Company.*

TEXTS AND LABELS

EXERCISES

Draw the San-serif, single line alphabet from given copy. Plate 7.

1. Capitals, lower-case letters, figures from 1 to 10; name and division of class.

Design the sheet so that the alphabets, figures, etc., commence and end an even distance from the right and left edges of the paper and are so grouped that the whole appears as a unit and not scattered over the sheet.

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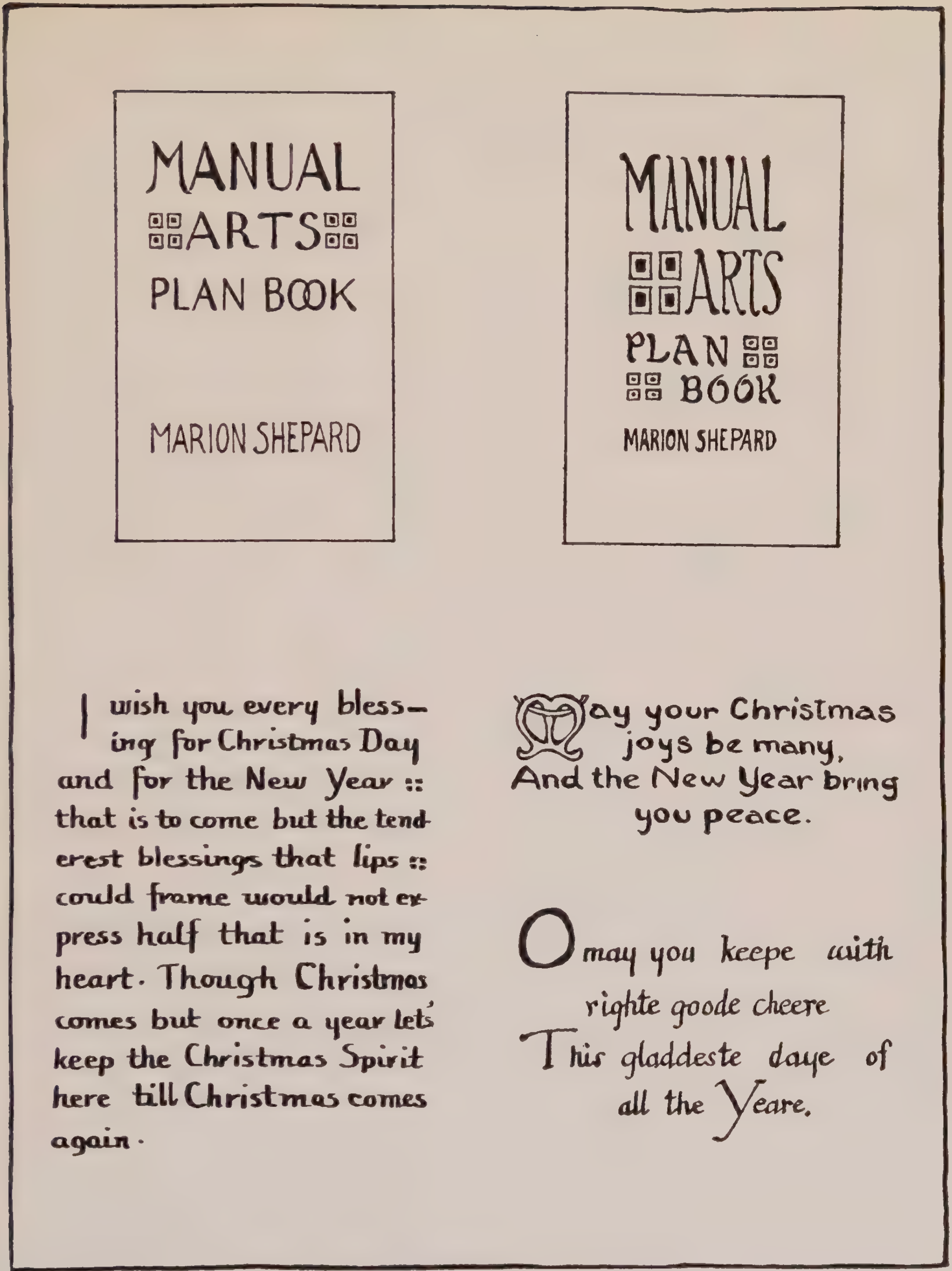
* From Writing, Illuminating and Lettering. By permission of the Macmillan Company, New York.



MANUAL
ARTS
PLAN BOOK

MARION SHEPARD

MANUAL
ARTS
PLAN
BOOK
MARION SHEPARD

I wish you every blessing for Christmas Day and for the New Year :: that is to come but the tenderest blessings that lips :: could frame would not express half that is in my heart. Though Christmas comes but once a year let's keep the Christmas Spirit here till Christmas comes again.

May your Christmas
joys be many,
And the New Year bring
you peace.

O may you keepe with
righte goode cheere
This gladdeste daye of
all the Yeare.

PLATE 9. LABELS AND TEXTS (NORMAL STUDENTS' DRAWINGS)

2. Draw the modified Roman alphabet from given copy, following above instructions.
3. Draw manuscript writing from copy. Rule light guide lines in pencil; print with pen. (See Plate 8.)
4. *Methods Note Book label.*

    Size of label, 3 by 1⅞ inches.

    Title:—Manual Arts.

    Methods Note Book.

    Name.

    Space by sketching in oblongs as directed, for three sizes of letters. Manual Arts largest, one size; Methods Note Book or Plan Book smaller, one size; Name smallest, two sizes. Use capital forms throughout. (See Plate 9.)
5. *Phonic cards. (For Primary Reading Classes.)*

    Size of cards of extra "strong tag," 6 by 4½ inches. Find center of card by drawing diameters. Measure up and down on center line ½ of an inch from center; right and left, 7/16 of an inch from center. Complete rectangle, 1 by ⅞ of an inch for "normal" letters. Add to this ¼ of an inch above or below for ascending and descending letters, as b and p. Double letters increase to 1 by 2 inches with ¼ of an inch between letters.
6. Christmas card and text, or calendar.

    Design the following:—

    (1) Dimensions of the card.

    (2) Proportions of the margins (the low margin should be the widest; right and left, the same width).

    (3) Proportion of the space for the text and for the ornament (if any). (See directions on design.)

    (4) Proportions of the panel for the ornament, which should be set off from the text by a space.

    (5) Proportions of the space to be filled by the text. Space the text in manuscript writing in a "solid block," *i. e.*, each line should begin and end at the given margin. When this even effect cannot be obtained without too noticeable changes in the natural spacing of the words it may be done by inserting small design units, the height of the letters of the text.

7. Posters, notices, or booklet titles.
    Design by "sketching-in" a poster or notice or booklet title in Roman letters. (Need not complete careful drawing of sketch.)
8. Day's program on the blackboard.
    Follow dictation in any one of the styles of printing named.
9. Enlarge small map or diagram according to the following rules:—
    (1) Enclose map or diagram in an oblong.
    (2) Draw an oblong same size on blackboard or paper.
    (3) Draw its diagonal, and extend it on one end until the diagonal is equal in length to that of the required oblong.
    (4) Draw the sides for the enlarged oblong, the length of which have been determined on the diagonal last drawn.
    (5) Divide original oblong into quarters or eighths.
    (6) Divide enlarged oblong into the same number of divisions.
    (7) Copy outline, using net of oblongs as guides for correct proportions.
10. Label enlarged map or diagram on blackboard.

REPRESENTATION

Representation is a term used to describe all forms of drawing which show the appearance of objects. In school drawing it is sometimes called "Freehand Drawing" or "Pictorial Drawing," "Object, Animal, and Pose Drawing," etc. When used in DESIGN, it is the language of the Fine Arts. As taught in the schools its purpose is three-fold: First, to develop in the pupil some technical skill, to help him "to learn how to draw"; second, to help him to acquire a knowledge of objects in terms of the objects themselves,—that is, to know more about an object because he has drawn it; third, through participation in various *modes of expression*, accompanied by the study of works of art, to arouse in him an interest that shall enable him to understand and appreciate pictures, and create in him an æsthetic response to beauty in art.

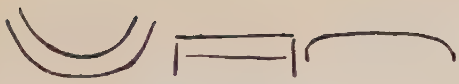
Ability to Draw

The ability to represent objects is not wholly dependent upon a native talent in that direction, although commonly supposed to be. The power to represent objects in picture form depends upon an educated sense perception of direction of line and proportion and shapes of surfaces, as well as upon a knowledge of the laws which govern their appearance as known in the Science of Perspective.

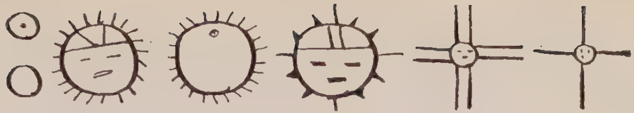
It therefore may be a matter of intelligent thought as well as of native feeling; a matter of a "visual knowledge of objects" as well as of an æsthetic appreciation of them. When the mind is able to think shape and proportion of surfaces, that is, "shapes and measures," it can acquire the few laws of perspective necessary to the delineation of elementary forms of representation. Like all forms of art it is necessary also to have systematic and continuous practice in the expression of it.

PICTURE WRITING

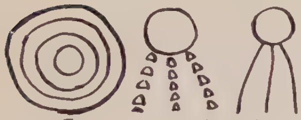
In its most primitive form, Representation is Factual Drawing and Picture Writing. Factual Drawing is an attempt to represent the facts about an object without any regard to its appearance, and Picture Writing is an art which conveys an idea by using the representation of



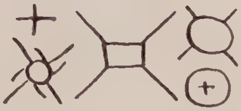
Sky



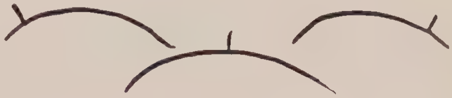
Sun



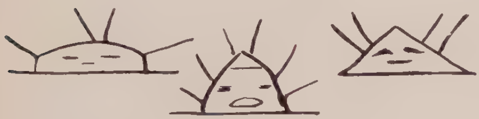
Sun and light



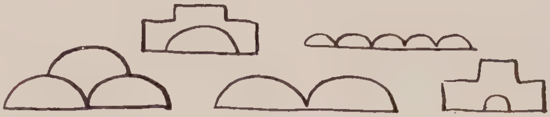
Stars



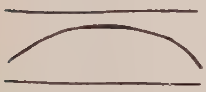
Day



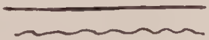
Morning



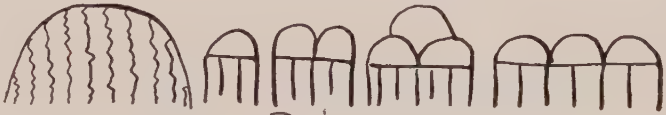
Clouds



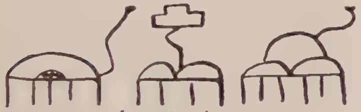
Clear



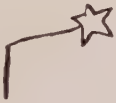
Stormy



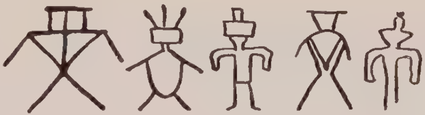
Rain



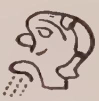
Lightning



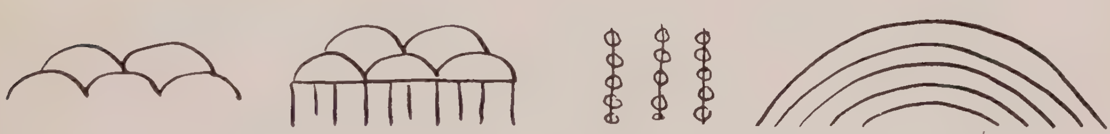
Meteor



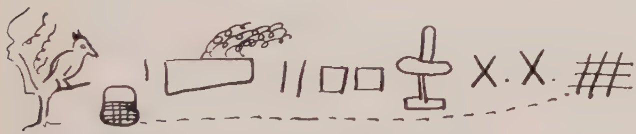
Human Figures



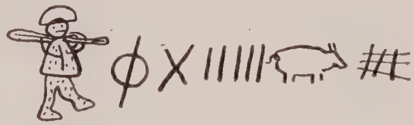
Talk



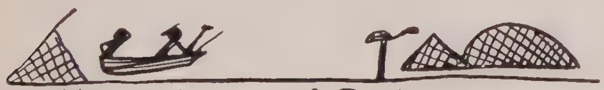
First clouds appeared in the sky, then it grew darker and rained for five days.



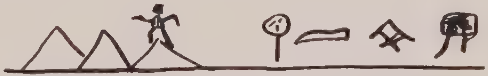
Old Indian Woman called the Owl, gives basket for tobacco and 2 quarts of Kerosene oil valued at 20 cents. Account closed.



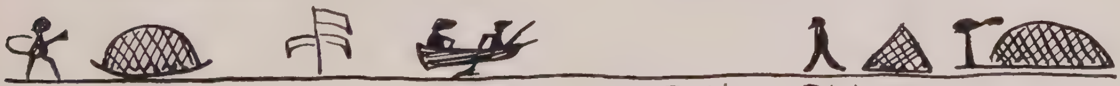
Indian receives pork, value $\$1^{15}$ for bundle of basket wood. Crossed lines show cancelled account.



Alaskan Notice of Distress



Alaskan Notice of Departure and Refuge.



Notice of Departure to Relieve Distress

PLATE 10. INDIAN PICTURE WRITING

objects reduced to symbols. Picture Writing was used by all people before the present writing symbols were developed and is, with Factual Drawing, a natural mode of expression with little children.

It is also the form of drawing seen in the cartoons and the picture stories in the newspaper Comic Supplement.

Although these forms of Representation are not drawing in any sense of accurate representation, they are a kind of graphic language and may be called the "beginning of drawing." They seldom lead to the power to represent "objects of vision," unless the drawing of the forms employed become a part of serious drill and study.

EXERCISES

PICTURE WRITING

1. Copy a number of Indian symbols from given chart.

2. Combine some of these symbols to make an intelligible sentence.

3. Copy from the Tenth Annual Report of the Bureau of Enthology (see plate 11):—

(1) Portions of the Ojivwa Chant (pp. 231-2), an Indian Chant used at the initiation of a new member into the Grand Medicine Society. (Used in the same manner as an illustrated musical score.)

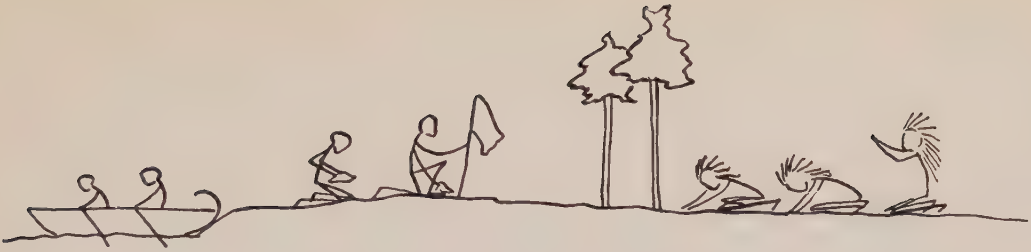
(2) A Shop Account. (p. 261.)

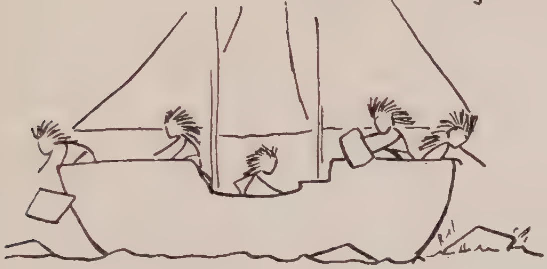
(3) Lone Dog's Winter Record. (p. 266.)

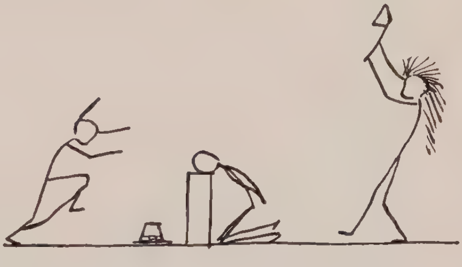
4. Invent a few symbols which represent ideas, and combine in rebus form.

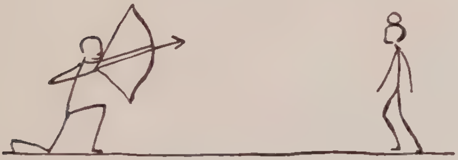
5. Illustrate a child's rhyme or story in Picture Writing.

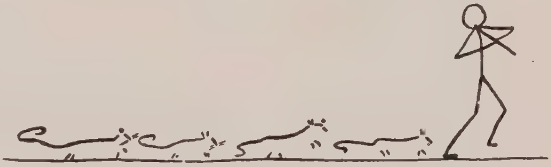
6. Collect specimens of this form of art from newspapers.

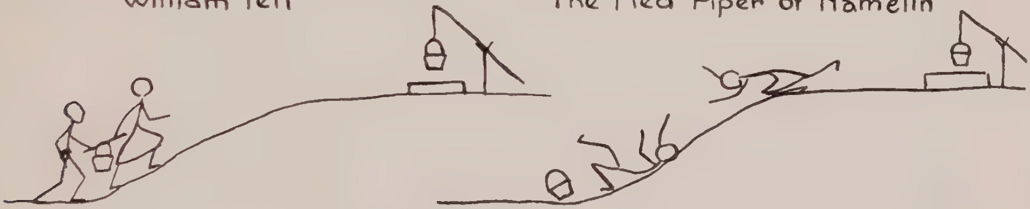

The Landing of Columbus

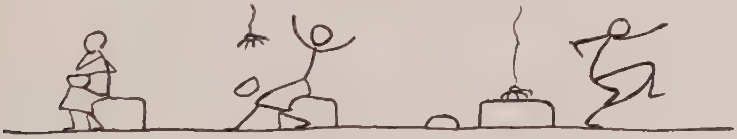

The Boston Tea Party

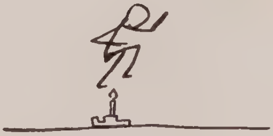

Pocahontas and John Smith


William Tell


The Pied Piper of Hamelin


Jack and Jill


Little Miss Muffet


Jack Be Nimble

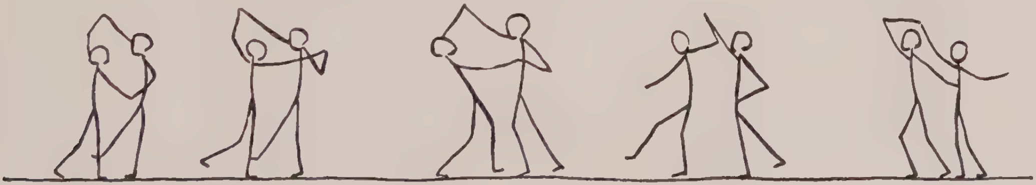

Dancing

PLATE 11. STORIES IN PICTURE WRITING

MODES OF REPRESENTATION

Various modes of drawing have been used by artists of different times and countries, and, like historic forms of ornament, have produced "style" in Representation. These modes have furnished suggestions for the variety of expression found in School Drawing and they may be defined as follows:

Mode I. Drawing in Lines and Outlines, called "Outline Drawing," in which the edges around the shapes, called the "contours," and the leading lines within the shapes, are drawn. (See Plate 12.)

Mode II. Drawing in lines and flat tones, called "Outline and Flat Tone Drawing," in which the outline drawing is filled in with flat tones of dark and light or in flat colors of different values and intensities.

Mode III. Drawing in tone without an outline, called silhouette or "mass drawing," in which the shape is "massed in" flat in one value or color.

Mode IV. Drawing in light and dark tones without an outline, called "drawing in values or color tones," in which shapes are "massed in" in dark and light and color, "shape to shape." (See Plates 16 and 17.)

Mode V. Drawing in light and shade, called "modeled drawing," in which lights and shadows are added to the "massed in" shapes previously drawn in values and color tones. (See Plate 18.)

Some fine examples in art expression have been done in "outline and flat tone drawing," notably those of Japanese and Chinese art, and modern forms of illustration seen in children's books and in magazines.

The representation of solidity by the addition of perspective, light, shade, and shadow, produces a more realistic form of expression and until recently was the only one employed in our own Western (and therefore familiar) examples of drawing and painting.

There are two kinds of Representation used in schools; one which might be called Primary Drawing, represents shapes and measures of surfaces and of objects in two dimensions only. Its aim is to develop the sense of proportion and direction, and the power to see shapes, as well as to give in the simplest way the character of the objects represented. The other more advanced form of drawing represents the third dimension, that is, the solidity of objects, and introduces the science of foreshortening and perspective.

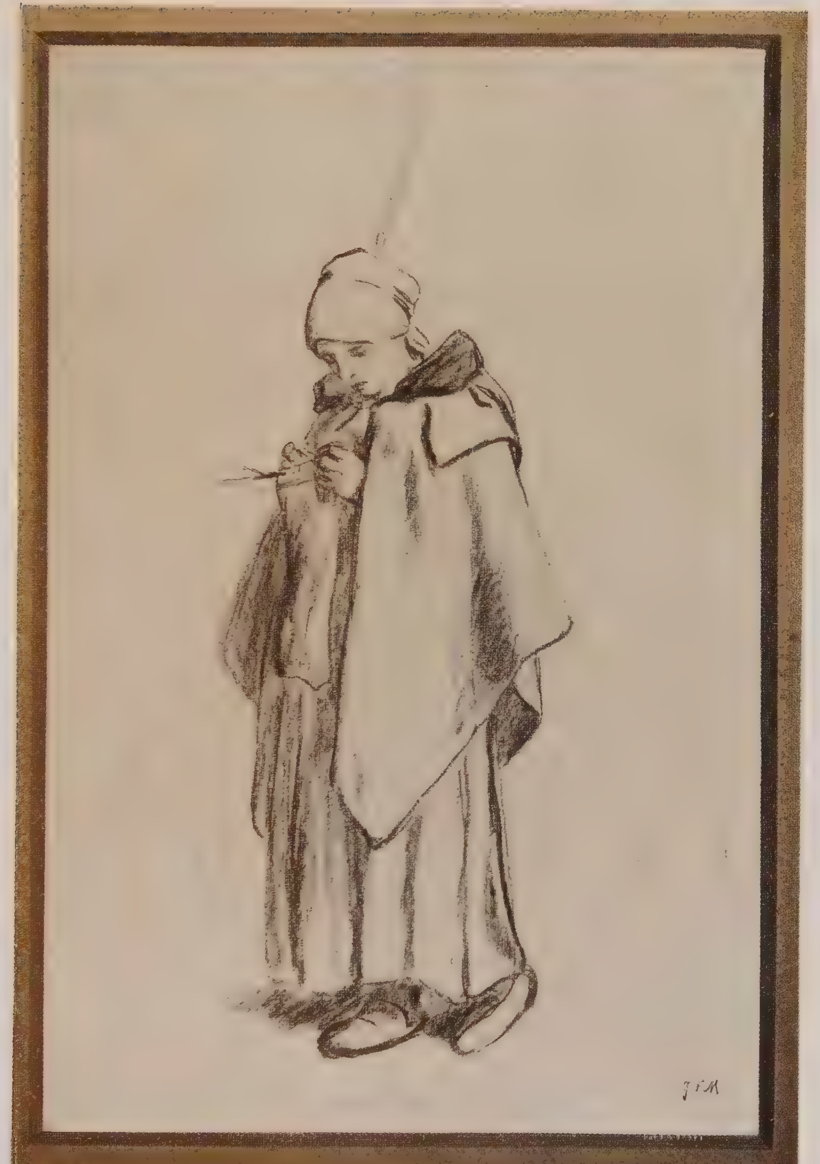


PLATE 12.

THE KNITTER
Drawing by Millet
Boston Museum of Fine Arts

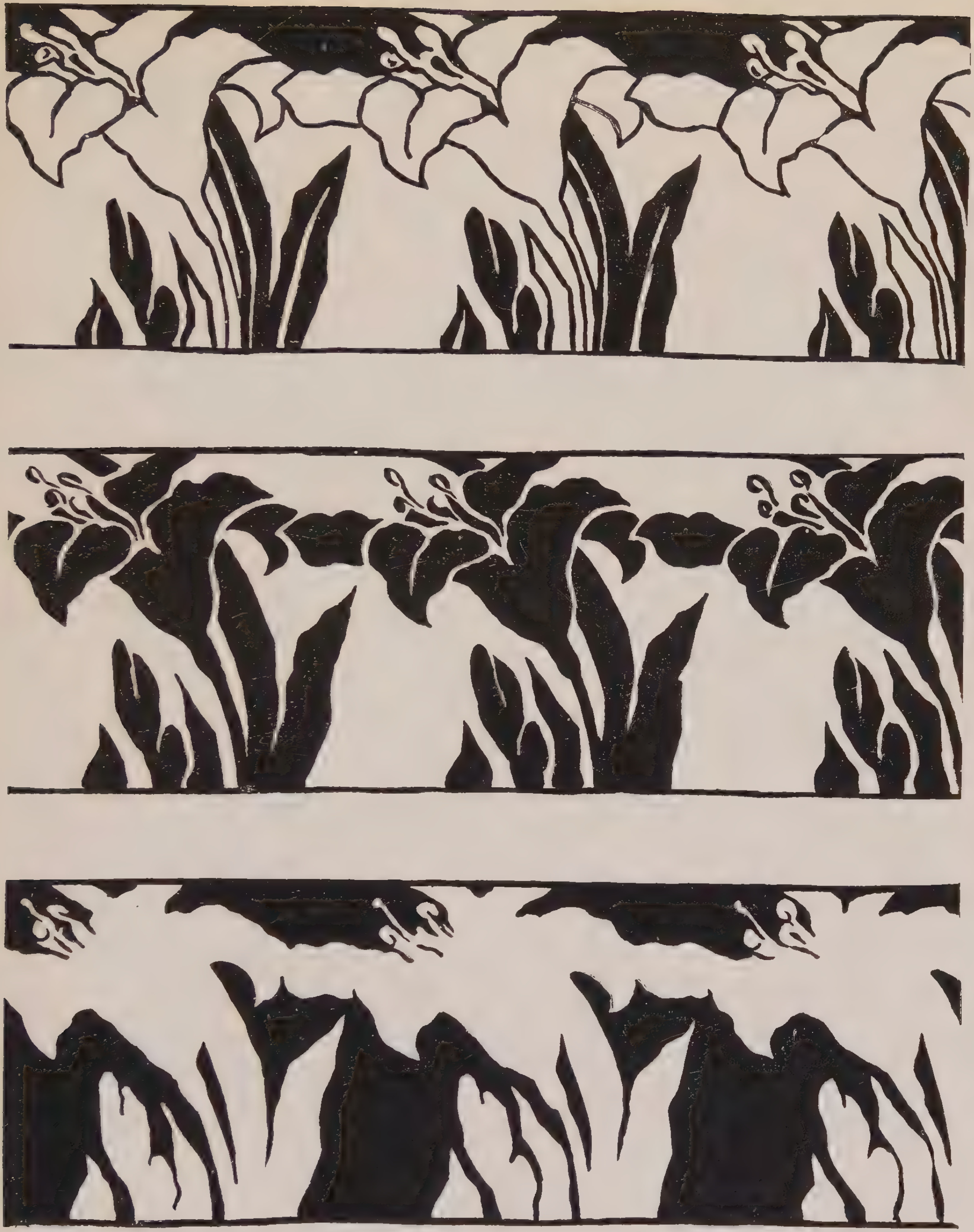


PLATE 13. OUTLINE AND FLAT TONE DRAWING

GENERAL DIRECTIONS FOR NOTE-BOOK AND PORTFOLIO DRAWINGS

For Methods Note Book Drawings. Make three drawings of each subject. In the first drawing show only direction of line ("attitude, position, action"); in the second, show direction of line and approximate shape; in the third repeat the first two and add the definite contour and details. Use light soft black pencil lines for "sketching in"; do not use the eraser. For the third drawing, if in outline, use sepia pencil on top of black pencil sketch, and do not erase sketch underneath. If in silhouette, paint in the shape directly; if in "massed in" crayon or pencil, mass in shape in even, flat, broad lines; if in cut-out paper, cut approximate shape of paper, draw contour into this shape, and cut out on contour lines, or cut out contour without any sketch line.

For Portfolio Drawings. Select the best medium to express the character and *texture* of the specimen or object to be drawn, and the kind of drawing to be made.

1. If "outline drawing" is selected, express the contour in an "artistic rendering" by dark and light, broad and narrow lines, with a soft lead or sepia pencil. Each change in contour should be suggested by the character of the object and by the effects of light upon it.

2. If "outline and flat tone" drawing is selected, express the contour by a clear outline in pencil or ink, and "fill in" the shapes with flat colors of carefully considered value and intensity.

3. If value tones in sepia, black pencil, or charcoal are selected, express by broad effects of light and dark in even flat tones.

4. If *colored crayon* is selected try by direction and quality of stroke to represent the texture of the object, as in birds—the feathers; in trees—the leaf clusters, etc. Show dark and light effects and variation in color hues, *by using one crayon over another.* Use the dominant color for the under or first color used, that is, "mass in" first with a dominant color and then add the local colors.

5. If *water-color* is selected, paint in the shape with clear water; upon the damp surface use clear color—varying the hue as you paint—and try to express broad effects of light, dark, and color. Add simple details to the damp drawing with drier color, but do not *work back* into the wet paint. If you wish to paint over, wait until the first paint is dry.

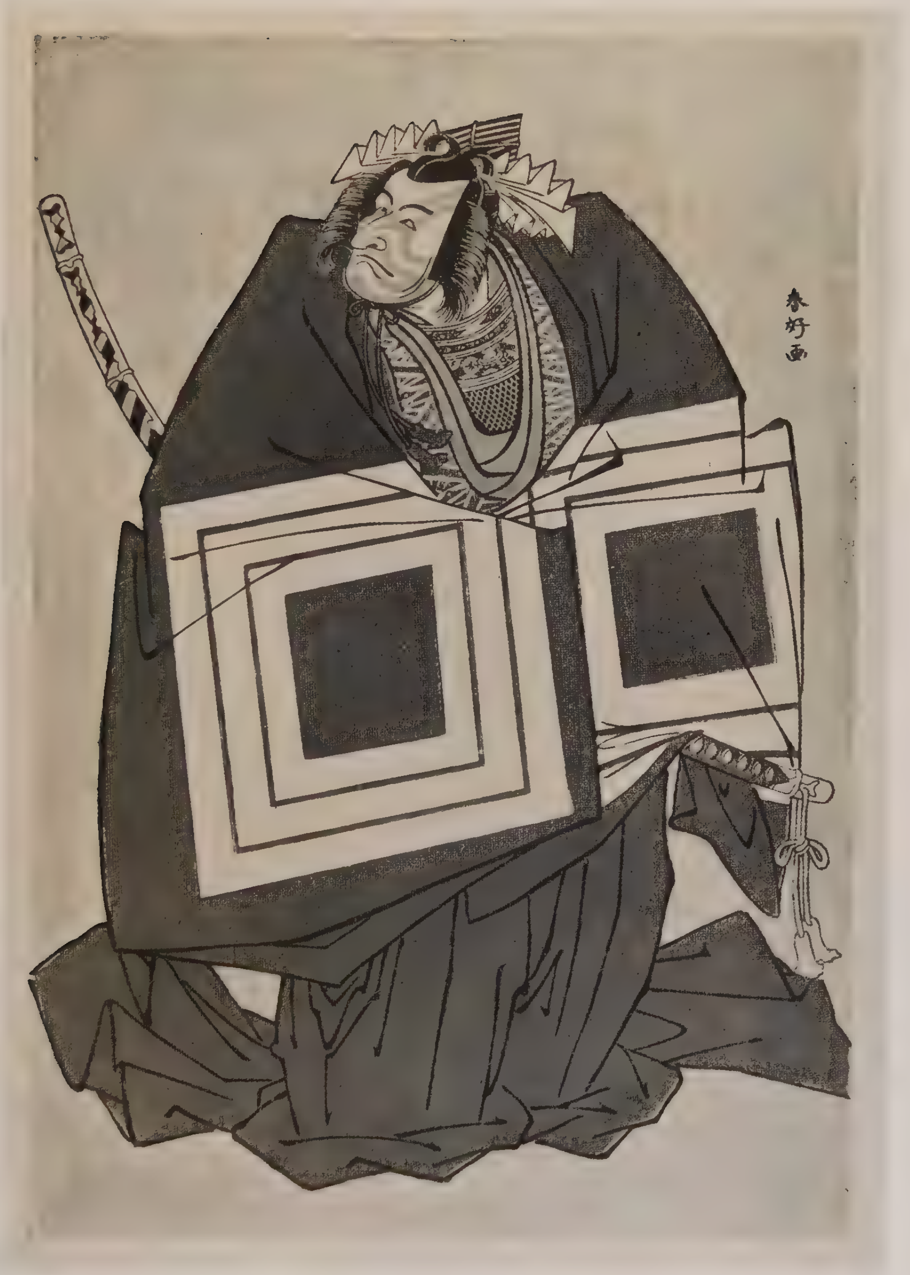


PLATE 14. JAPANESE PRINT

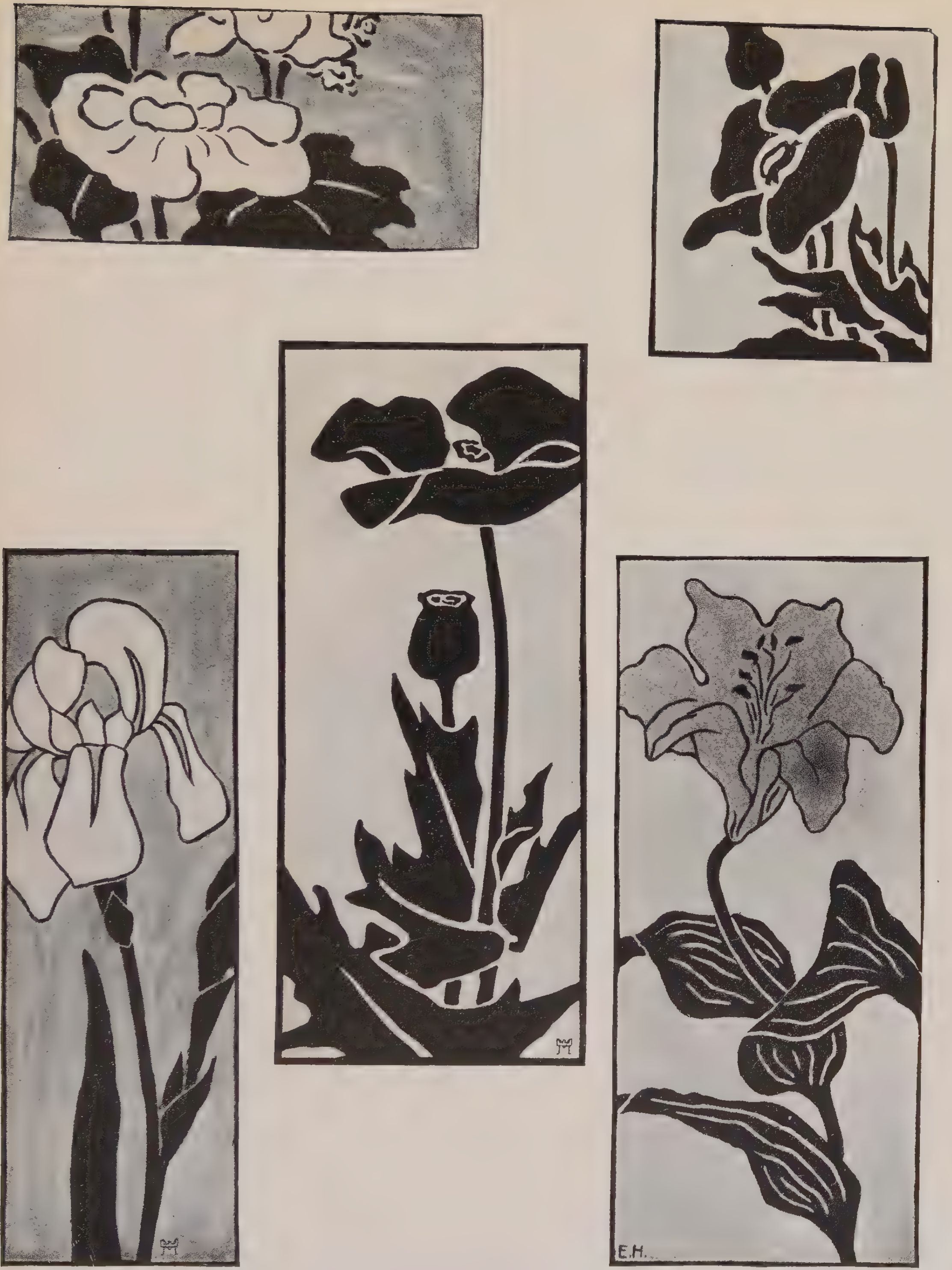


PLATE 15.

From *Theory and Practice of Teaching Art*
By Arthur Dow

BEGINNING DRAWING

SKETCHING

In the most elementary forms of drawing, objects are represented by lines of direction, and by lines of direction and approximate shapes. By direction is meant action, attitude, position, or posture; the way a figure or object rests, stands, grows, or moves.

After the attitude (direction) has been established, the general or approximate shape of the object is built upon it. This shape may be given in mass or in outline. Nearly all forms can be reduced to typical shapes, such as rectangular, oval, circular, etc., but the idea is to think of the whole object as a *simplified shape* without detail of contour. The term "sketching in" might be applied to this mode of expression. (See Plate 19.)

EXERCISES

Make the following, allowing not more than a minute or two for each sketch:

1. Copy twenty drawings of objects from charts. Represent in two dimensions only and with no defined contours, the direction and approximate shape.

2. Sketch forty different objects in same manner as Exercise 1. Be careful to represent correct proportions and attitude, but do not draw any details.

3. Sketch from copy twenty action figures, using lines of direction only.

4. Repeat ten of the above, sketching in the approximate shape of the clothing.

5. Sketch three figures from life, using direction of line only; add approximate shape of clothing.

PLATE 16.

THE EWE LAMB
By William M. Hunt

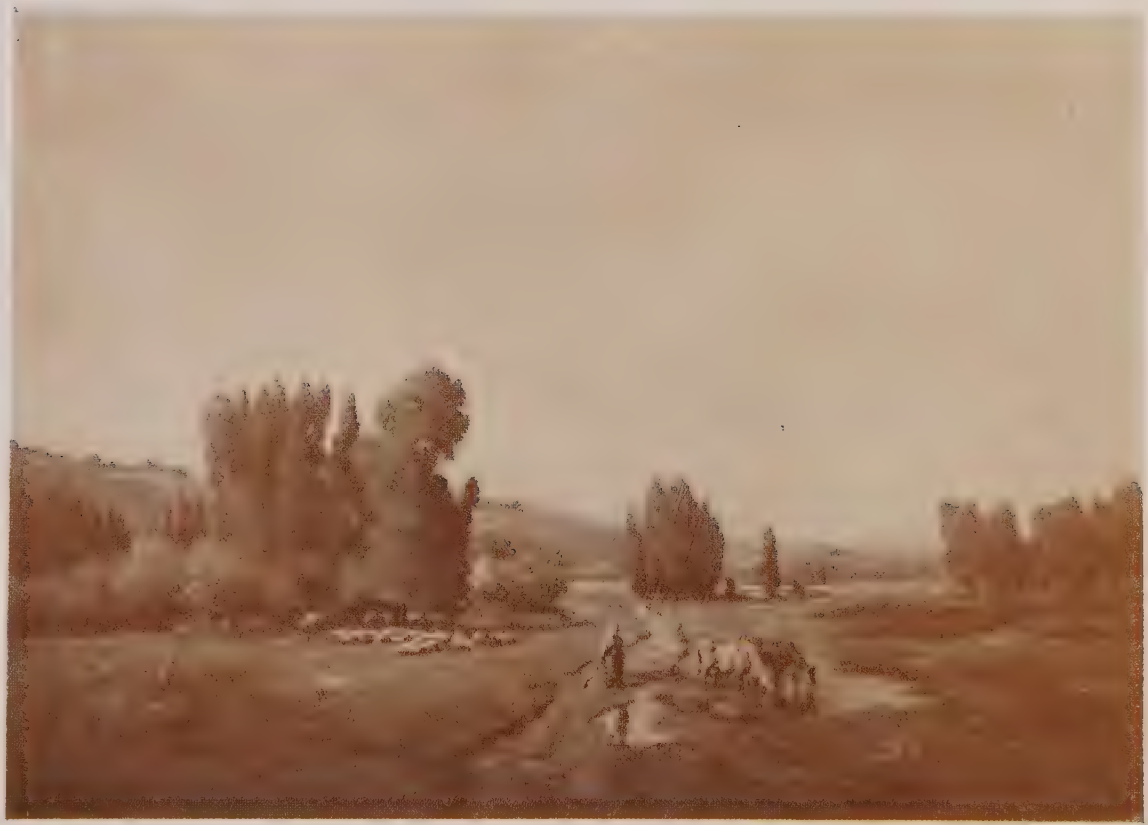


PLATE 18.

LANDSCAPE BY ROUSSEAU
Boston Museum of Fine Arts

PRIMARY DRAWING

In order to represent "objects of vision" we have said that a knowledge of these objects and the ability to express this knowledge in terms of drawing must become a part of serious drill and study.

For this purpose the following methods of study and expression are given: Common elements which appear in pictures (to be used later in picture illustration and composition), and objects associated with children's interests, have been selected for study. The same method, with varied application according to the different materials used, prevails throughout. *First,* the attitude, action or position (line of direction) of the object is seen and indicated. *Second,* its general or approximate shape "sketched in" either as one shape, or made up of "shapes to shape." This "sketching in" may be by "lines and outlines" as in Beginning Drawing or by "massed in" shapes expressed by planes of light, dark, and color. *Third,* the contour (edges around the shapes) is next studied and expressed to give more definite character to the representation and to refine the "sketched in shape." *Fourth,* broad, simple effects of light, shade, and shadow added. Foreshortened surfaces may be represented as shapes, but without a scientific knowledge of perspective principles. The aim of "Primary Drawing" is to represent in drawing of two dimensions, simple pictorial elements, and to develop by practice and observation the sense of direction and proportion, *i. e.,* power to see and represent "shapes and measures."

DIRECTIONS FOR DRAWING BIRDS

Method I. 1. Draw the leading line giving the action or posture of the bird. This line may be the backbone or skeleton of the bird, or a leading line of the contour.

2. On this line sketch in, lightly, the general shape. For birds at rest, the typical or approximate shape of the body is an oval, for the head, an oval or circle.

3. Consider the measure of these shapes.

4. Draw the contour into this typical shape.

5. Notice and draw the especial characteristic of each bird. (The neck of the hen is short, of the rooster long, etc.) Beaks, length of wings, legs, and feet vary with each kind of bird. Feet resting on the ground are in a horizontal position, and the further leg appears the shorter. (See Plate 20.)

Method II. Instead of "sketching in" the shape in outline, it may be "massed in" with crayon, chalk, charcoal, or ink, and the contour developed out of the shape.

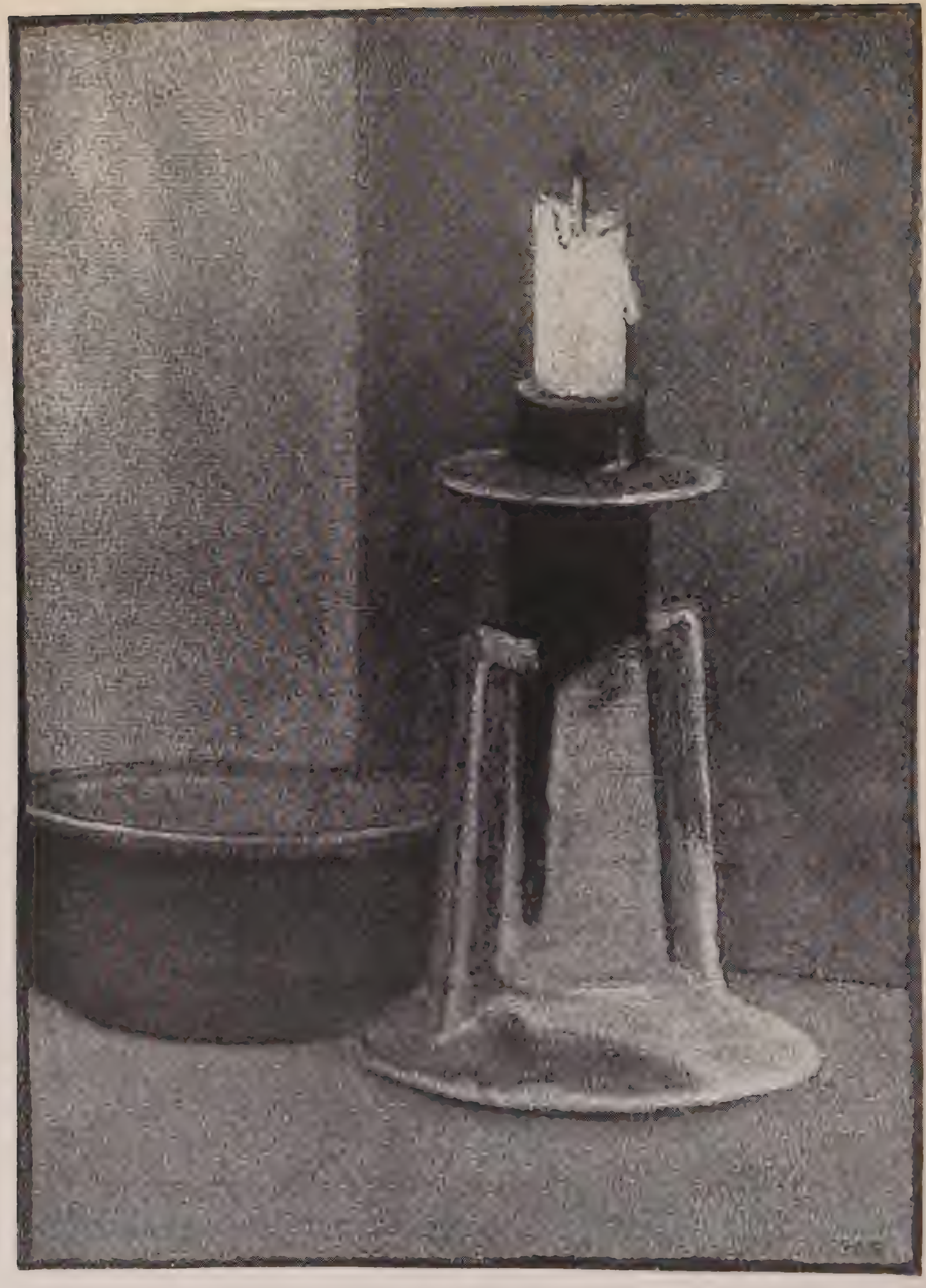


PLATE 17. FLAT COLOR TONES

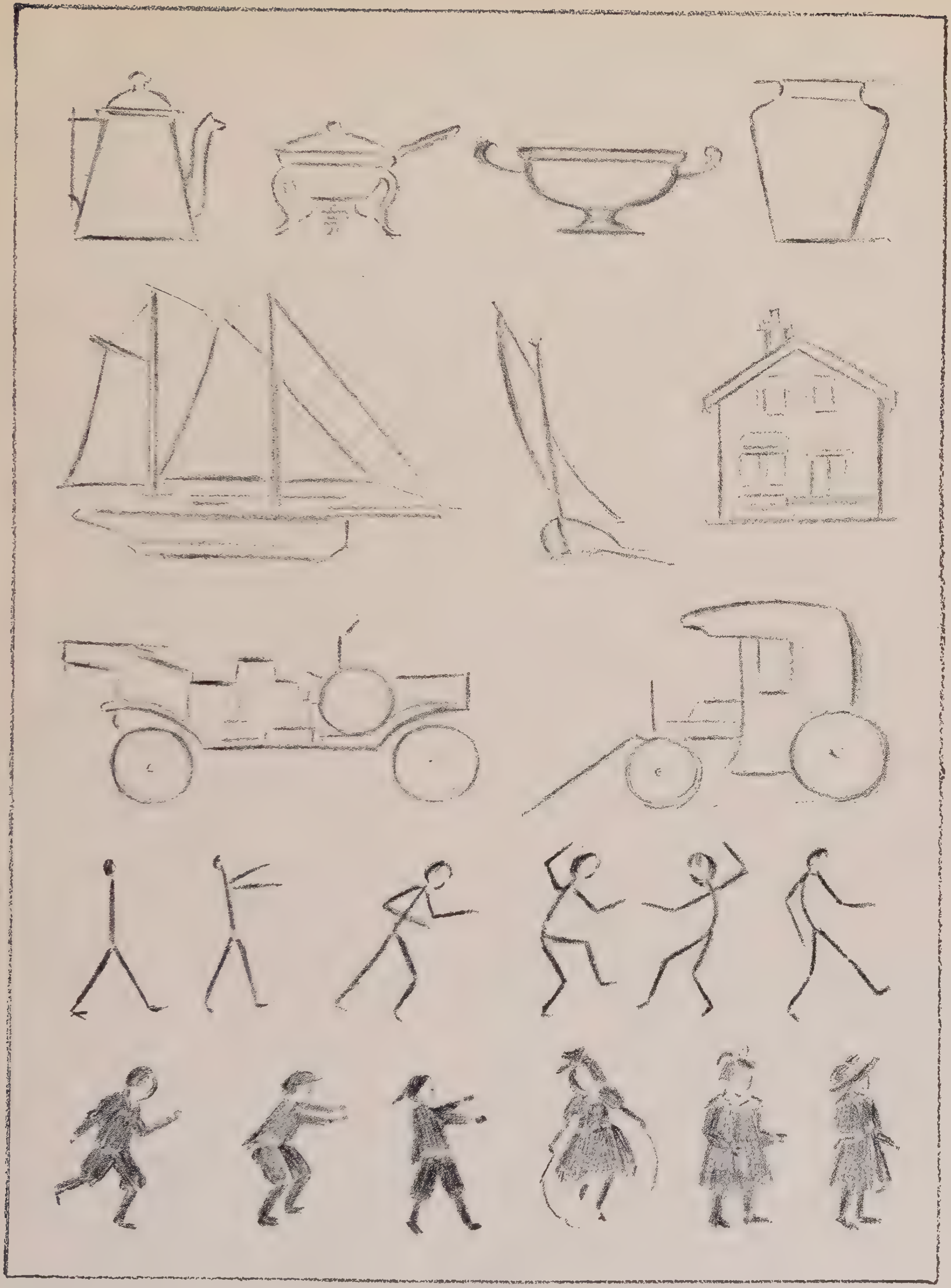


PLATE 19. SKETCHING

EXERCISES

BIRDS

METHODS NOTE BOOK

Make outline drawings of the following from given chart:

1. Chicken in three positions (nine sketches, three drawings).
2. Hen in two positions.
3. Rooster in two positions.
4. Duck in two positions.
5. Crow in one position.
6. Choice of any other.

MASSED IN DRAWINGS

1. Select any two of those previously drawn and paint in directly with brush and ink. (See Plate 22.)

2. Select as in No. 1, and "mass in" shape in crayon.

DRAWING OF DETAILS

Draw from mounted specimen of bird the beak, claws, markings of wings, tail, etc., using fine pointed black pencil.

PAPER CUT-OUTS

Make one paper "cut-out" of one bird in three different sizes. Cut out of tag paper or stencil board.

PORTFOLIO DRAWINGS

Make a finished drawing of one (or more) of the following from the mounted specimens:

Duck, Oriole, Blackbird, Blue Jay.

1. In crayon on colored paper which tones in with the prevailing color of the subject. (See Plate 21.)

2. In water color.

DIRECTIONS FOR DRAWING RABBITS, CATS, MICE, ETC.

Follow the preliminary directions for drawing the birds. In the case of these animals the approximate shape is an oval cut off on its long axis for the side view of the animal; an oval or circle for the front or rear view. Notice the character of the ears, eyes, nose, jaw, and tail, and variation in the curves of the contour. (See Plate 20.)

EXERCISES

Rabbits, Cats, Mice, Etc.

Methods Note Book

Make outline drawing from given charts of the following:

1. Rabbit in three positions.
2. Cat in two positions.
3. Mice in five positions.
4. Make ink silhouette drawing of any one of the above animals in three positions.
5. Make "massed in" crayon of same.
6. Make a pencil sketch from life.
7. One paper cut-out of animal in three sizes. (Tag or stencil board.)

Portfolio Drawings

1. Sepia pencil drawing from life or mounted specimen.
2. Crayon or chalk.

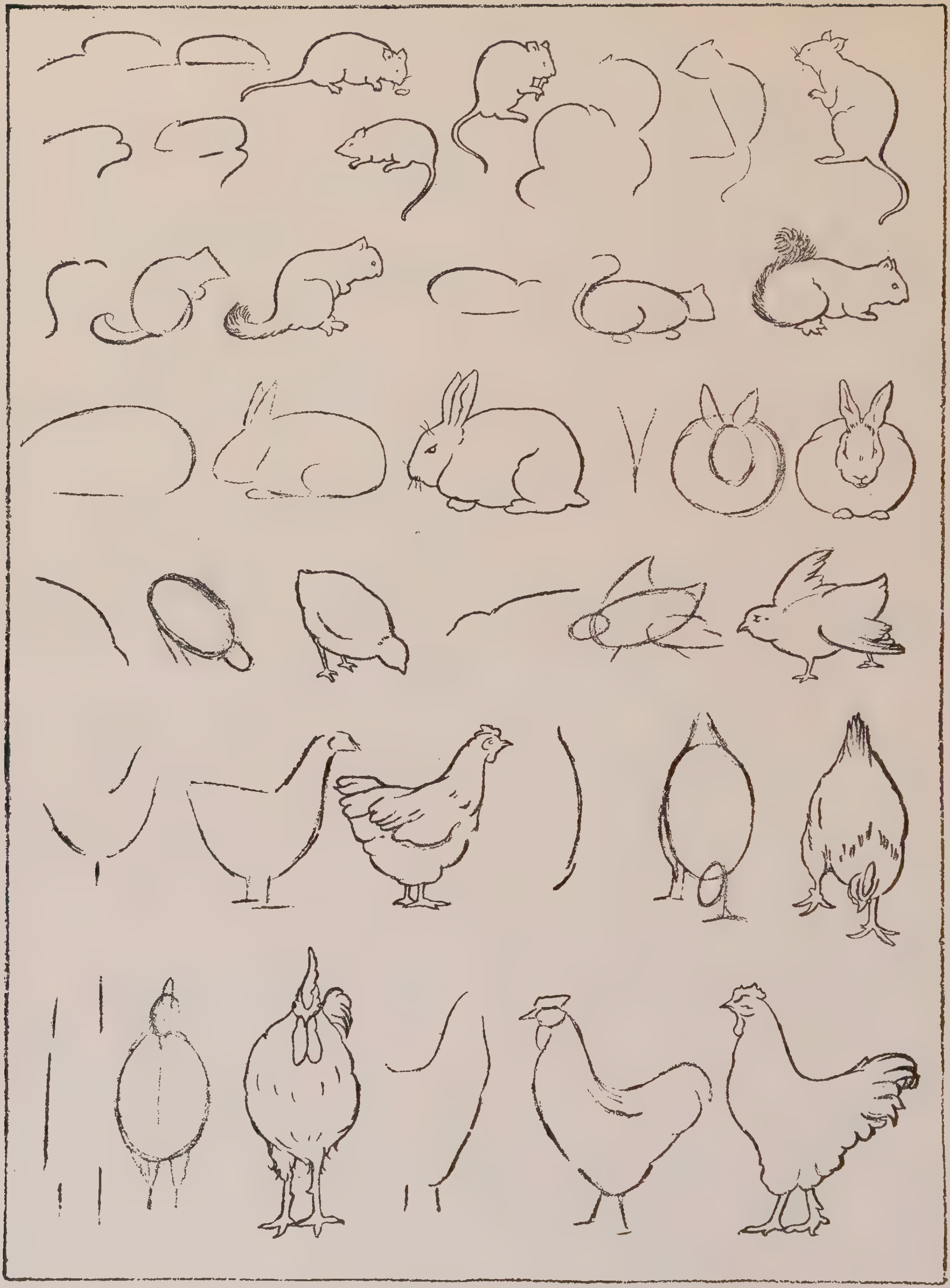


PLATE 20. BIRD AND ANIMAL FORMS BASED UPON THE OVALS

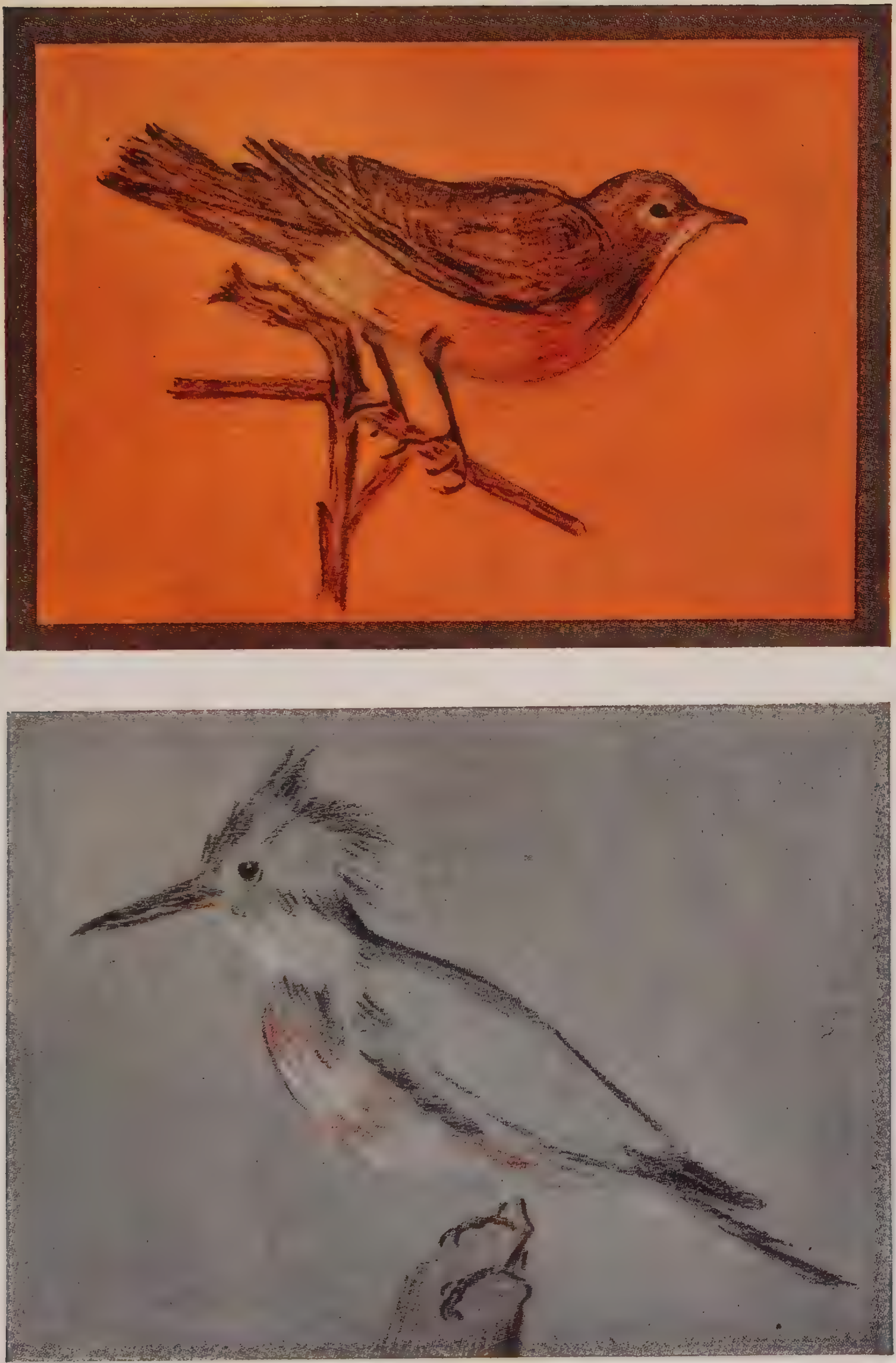


PLATE 22. CRAYON DRAWINGS — BIRDS

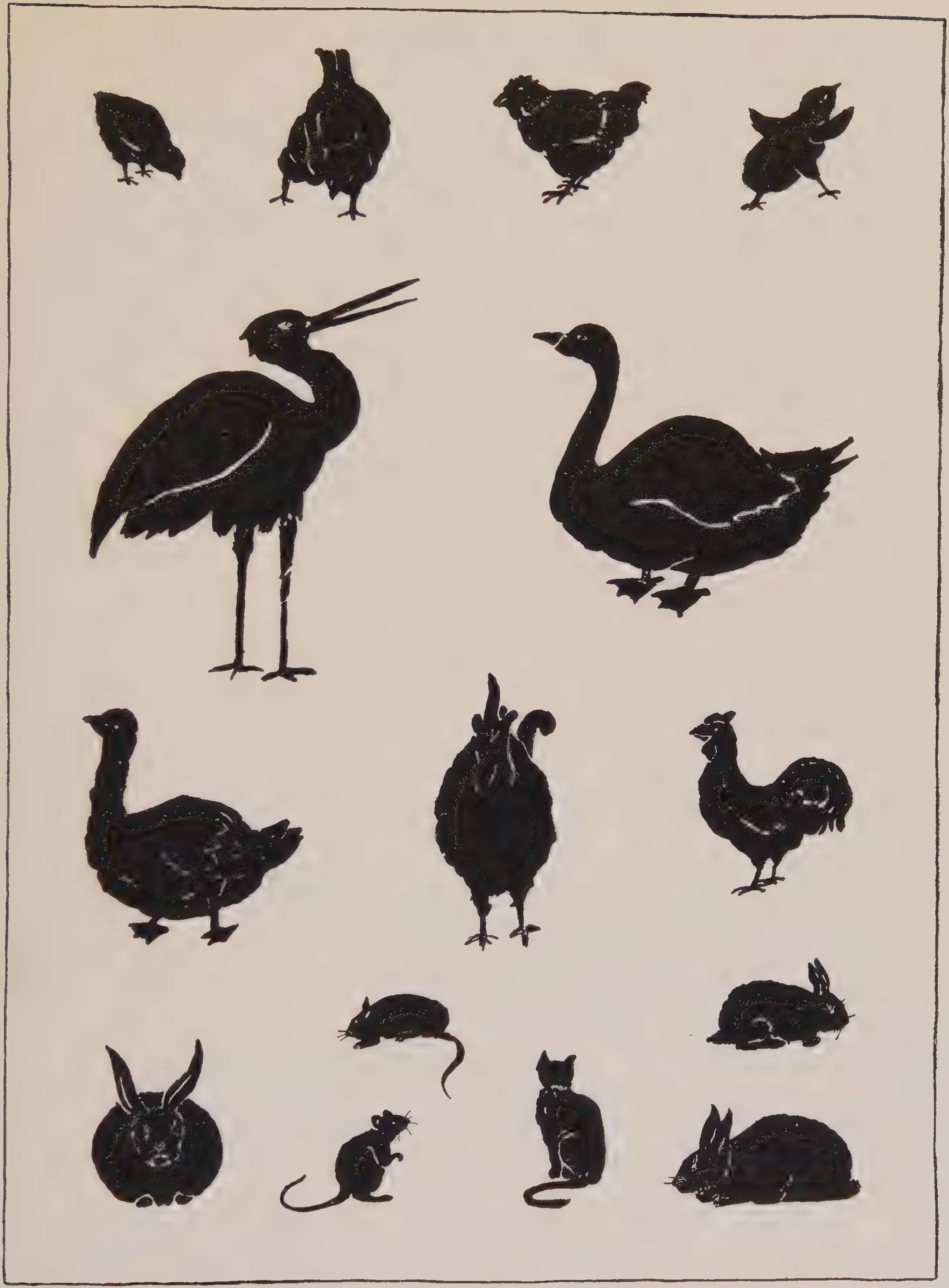


PLATE 21. BIRDS AND ANIMALS IN SILHOUETTE

DIRECTIONS FOR DRAWING DOGS, FOXES, WOLVES, HORSES, ETC.

Method I. 1. Draw the action lines which represent the skeleton of the side view of the animal when standing, give its attitude, and indicate its structure.

2. Draw the approximate shape of the body, which may resemble the form of the familiar hobby horse or a Dutch wooden shoe.

3. Draw the approximate shape of the neck, an oblong.

4. Draw the approximate shape of the head, which is often a triangle.

5. Consider the measures of these shapes.

6. Draw on these approximate shapes the contour of the animal. Notice the characteristic *curves* of this contour in each animal.

7. Add the details of ears, jaws, noses, tails, joints of limbs. Notice the placing and measures of each. (See Plate 23.)

Method II. 1. Draw the "action line" as in Method I.

2. "Mass in" the shapes with crayons or brush or ink.

3. Refine these "massed in" shapes to show the details.

EXERCISES

Dogs, Foxes, Wolves, Horses, Etc.

Methods Note Book

Outline drawings from given charts of the following:

Method I. 1. Fox in three positions.

2. Horse in two positions.

3. Camel in two positions.

4. Dog in one position.

Method II. 1. Ink Silhouette of any of those previously drawn.

2. "Massed in" crayon of any of those previously drawn.

3. Quick pencil sketches from life of horse or dog in three positions.

4. Paper cut-out of one animal in three sizes. (Tag or stencil board.)

Portfolio Drawings

1. Sepia outline drawings from mounted or live specimens of any animal built on the above structural shape; as elephant. etc.

2. Colored crayon drawing as in No. 1.

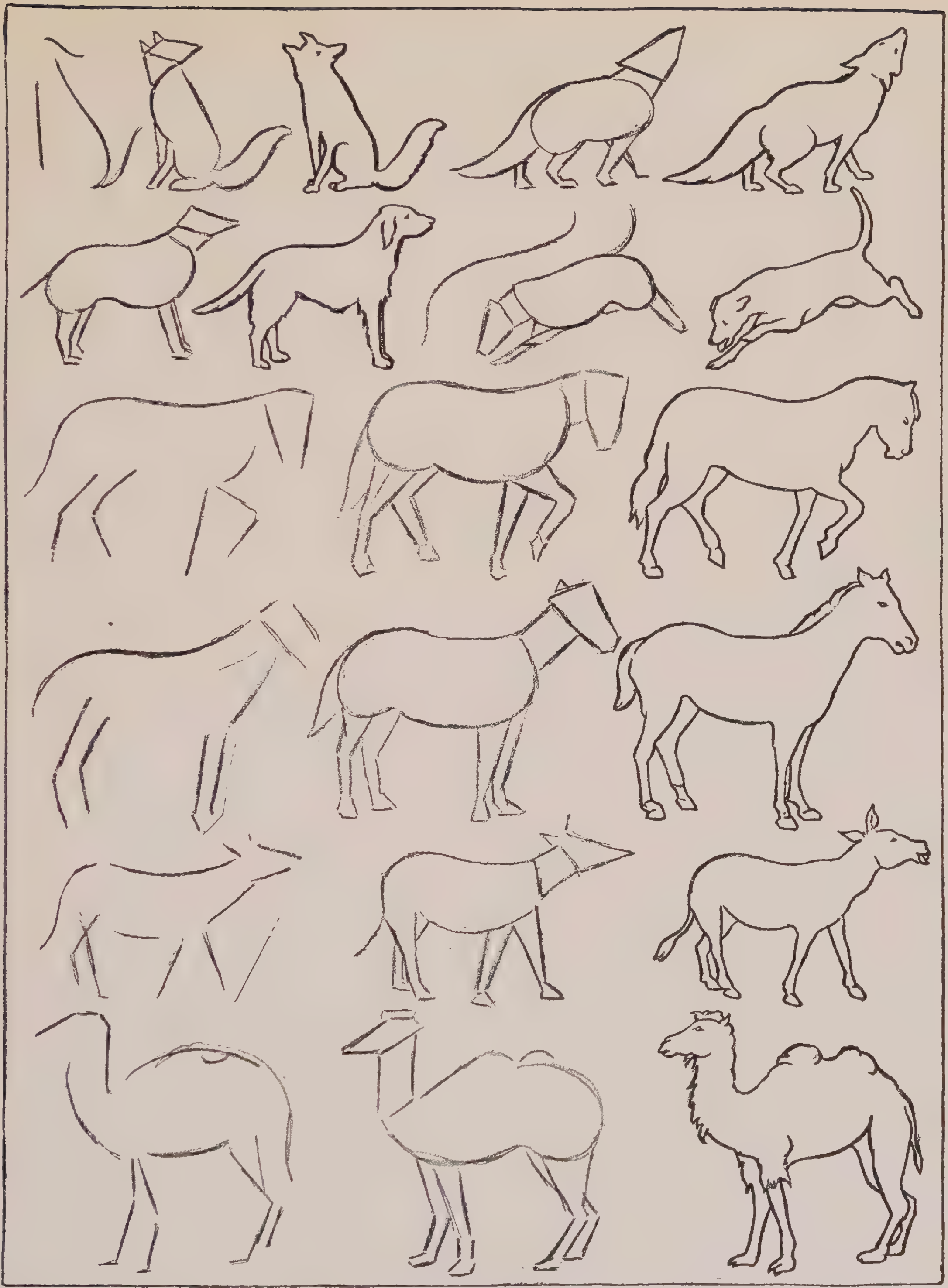


PLATE 23. ANIMAL FORMS DEVELOPED ON ACTION LINES

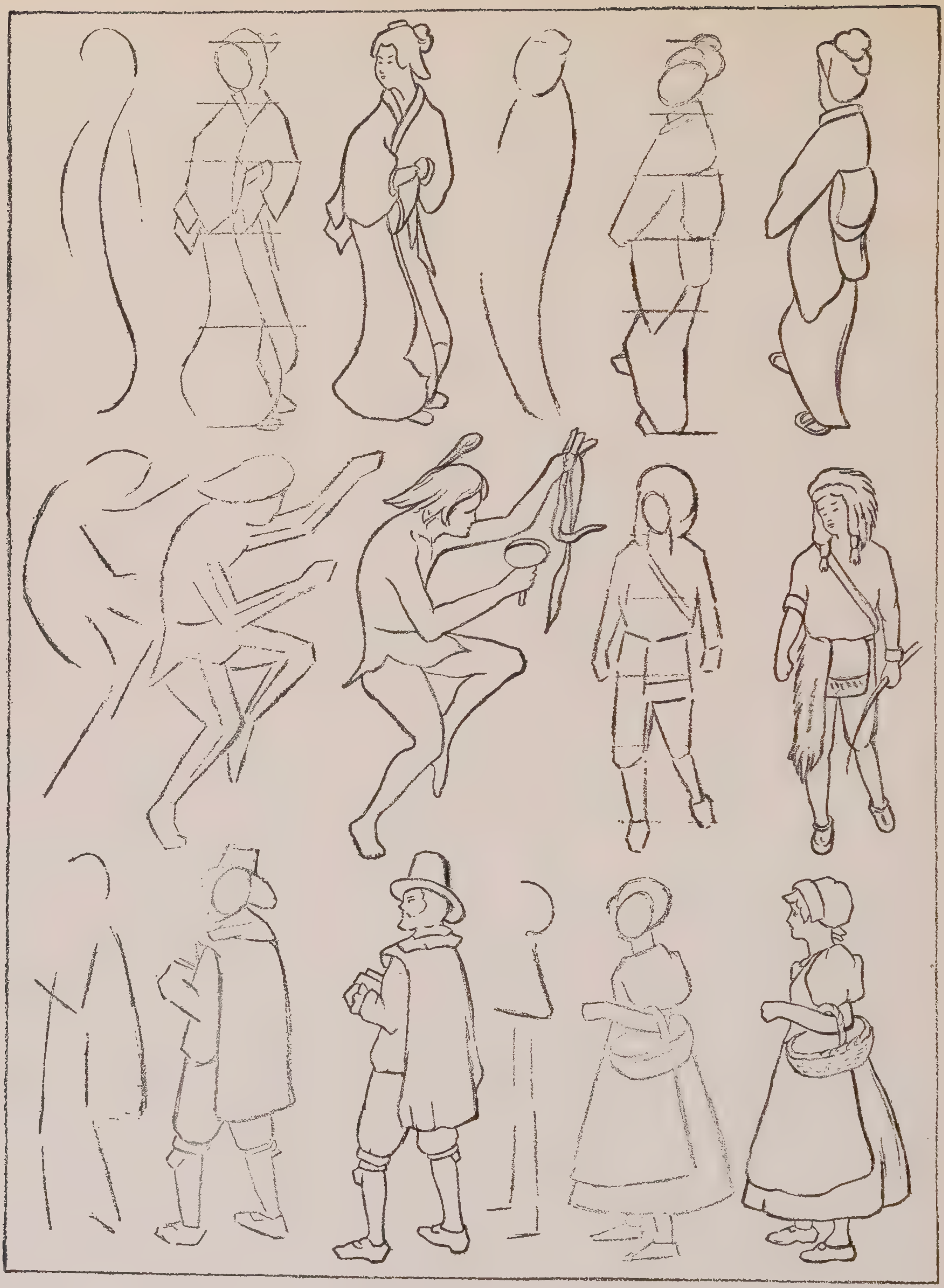


PLATE 24. FIGURES DEVELOPED SHAPE TO SHAPE

DIRECTIONS FOR DRAWING THE HUMAN FIGURE (POSE DRAWING)

Method I. 1. Draw the "action lines" which represent the skeleton or structure of the figure.

2. "Mass in" the shapes represented by the head and the clothes. (See beginning drawing.)

Method II. 1. Draw the action or attitude of the figure, which may represent the skeleton or structure or may represent a part of the contour of the clothing. (See Plate 24.)

2. Indicate the measures of the different parts of the body. Measures of the average adult are as follows: Upper half of figure divides approximately—Top of head and shoulders, ⅓; shoulder to waist, ⅓; waist to base of torso, ⅓. The lower half of the figure divides approximately into two parts, from base of torso to knee, and from knee to ankle. The distance from the top of arm to the elbow is the same as from the elbow to the wrist. The arm, when hanging straight down, extended full length, reaches to one-half the length of thigh bone. Feet and hands are about the length of the face. Adults are seven and one-half times the length of the head, children four or five times the length of the head.

Sketch on the "action lines" the approximate shape of the head, torso, and limbs. The shape of the head is an ovoid with the larger width at the top. Build up the shape of each part of the clothing as "shape to shape."

4. Refine the shapes and add details of costume to give character and expression.

5. Place the position of the features by horizontal or curved lines and dots, approximately as follows: The eyes are half way between the top of the head and the base of the chin; the space between the eyes is the width of the eyes. The eyebrows are a short distance above the eyes. The nostrils are half way between the eyebrows and the base of the chin, and the width across the lobes of the nose is the same as the width of the space between the eyes. The bridge of the nose is not drawn when the face is in full view. The mouth is one-third the distance between the nostrils and the base of the chin. The top of the chin is the other third between the nostrils and base of chin or half way between mouth and base of chin. The top of the ears is on a level with the eyebrows; the bottom on a level with the end of the nose. When the head is tipped, the features follow an elliptical line across the face.

6. Indicate the shape of the features to give character and expression.

EXERCISES

Pose for Figure Drawing

Methods Note Book

1. Draw from chart twenty or more figures showing action only. (These drawings are sometimes called "action figures" or "stick men.") See Beginning Drawing.

2. Select five of these action figures previously drawn and mass upon them shapes representing boys, girls, men, or women. See Beginning Drawing.

3. (1) Mount six figure prints from magazines or newspapers and draw the action lines into the pictures selected.

(2) Beside the mounted figure print with the action lines drawn upon it, copy the action lines only.

(3) Repeat the action lines and draw in the shapes of head and clothing. Notice carefully the position and measure of each shape, as well as the action and measure of the whole figure.

4. Draw three costume figures in colored crayons or water color from the charts. (Notice shapes.)

5. Draw six figures in ink silhouette, three from those previously drawn, three from life.

6. Six three minute sketches from life of the same figure or pose in costume.

7. One figure in three different sizes, cut out of paper.

Portfolio Drawing

1. Sepia pencil study by the Second Method of a pose from life.
2. Same in another position.
3. Same in colors, crayon, or water colors.

DIRECTIONS FOR DRAWING TREES

Method I. 1. Draw in light lines the general direction of the tree's growth, *i.e.*, the main trunk, main branches, and small branches. These show the structure of the tree. Remember that the branches *grow out* of the trunk, the twigs out of the branches; therefore let the pencil run back over the trunk and draw the branch from the trunk outward. Notice that the trunk and branches decrease in weight as they subdivide into new branches and end in delicate twigs, and notice that the branches

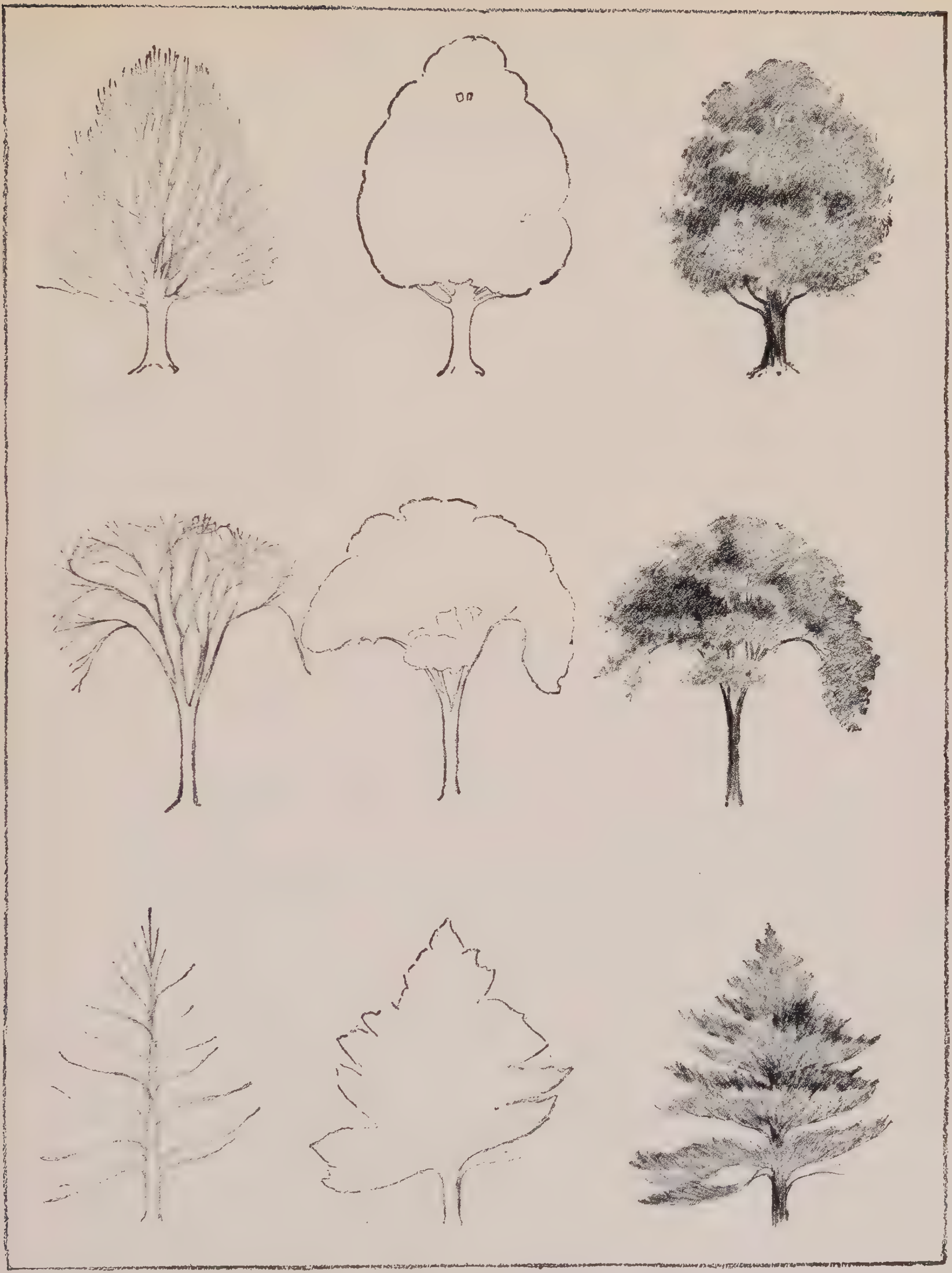


Plate 25. Trees — Structure, Shape, Light and Dark

grow out from all sides of the trunk and not from opposite sides only. Avoid "sawed-off" effects by leaving branches wide at their extremities.

2. Draw the shape of the whole tree.

3. Draw the shape of the large clusters of leaves within the general shape. Notice that these clusters often cover the trunk and branches; that is, that the trunk and branches disappear behind the clusters of foliage and that the trunk is not seen throughout its entire length.

4. Draw the shape of the large sky spots which show between the clusters of leaves.

5. Refine the contour.

Method II. 1. Proceed as for Method I. by sketching in the structure of the trees.

2. "Mass in" the shape in a flat tone of equal value.

Method III. 1. Sketch in the structure, general shape, and sky spots.

2. "Mass in" the clusters which are in the light with a stroke which shows the texture of the tree. Each tree may be represented by a stroke best suited to give the effect of its foliage: as a short side stroke for the maple; an upward and side stroke for the pine, etc.

3. "Mass in" the darks, in order to bring out the shape of the clusters and effects of dark and light.

EXERCISES

TREES

METHODS NOTE BOOK

1. Make three drawings of any three of the following: First, representing the structure; second, the general shape and sky spots; third, the "massed in" shape. By Methods 1 and 2. (From chart or nature.)
    - *a.* Maple.
    - *b.* Oak.
    - *c.* Poplar.
    - *d.* Apple.
    - *e.* Elm.
    - *f.* Pine.
    - *g.* Larch or Fir.
2. Draw ink silhouette of any two of the above.
3. Paper cut-out of each of the above.

PORTFOLIO DRAWINGS

1. Draw in sepia pencil two of the above.
2. Paint in water color any of the above in autumn leaf.

DIRECTIONS FOR DRAWING FRUITS, VEGETABLES, TOYS, ETC.

Shapes

Method I. 1. Draw in light line the attitude or position of the shape. This line may or may not become a part of the contour.

2. Draw in the approximate shape. This may be a circle, oval, rectangle, etc.

3. Draw the contour on the sketched-in shape. Notice the light and dark, the delicate and heavy edges, which give in outline the character of the object. Express these variations of contour by dark and light, thick and thin lines.

Method II. When the object is made up of assembled shapes as seen in many toys, a slightly different method expresses the object more easily.

1. Draw in the attitude by a leading line. (This may be the ground line on which the whole rests.)

2. Draw the various shapes, building up the drawing by adding shape to shape. Observe each shape carefully and compare its position and proportion with the other shapes.

Illustration

In drawing a toy engine, draw the leading line of the truck, then the large shape of the boiler, then the cab and other smaller shapes. Each object of this character must be studied in order to simplify its expression, and to find the easiest method by which it may be expressed.

Method III. 1. Draw in directly with brush and ink, the shape of the object. When the object is made up of assembled shapes, as a turned over leaf, a toy, etc., leave a line of white paper between the shapes in order to define them.

Method IV. 1. "Mass in" with colored crayons, using a stroke in harmony with the shape. When variation in hue is seen, "mass in" with an under color, as yellow, orange, etc., and put the other colors one beside the other, or one over another to produce the effect seen.

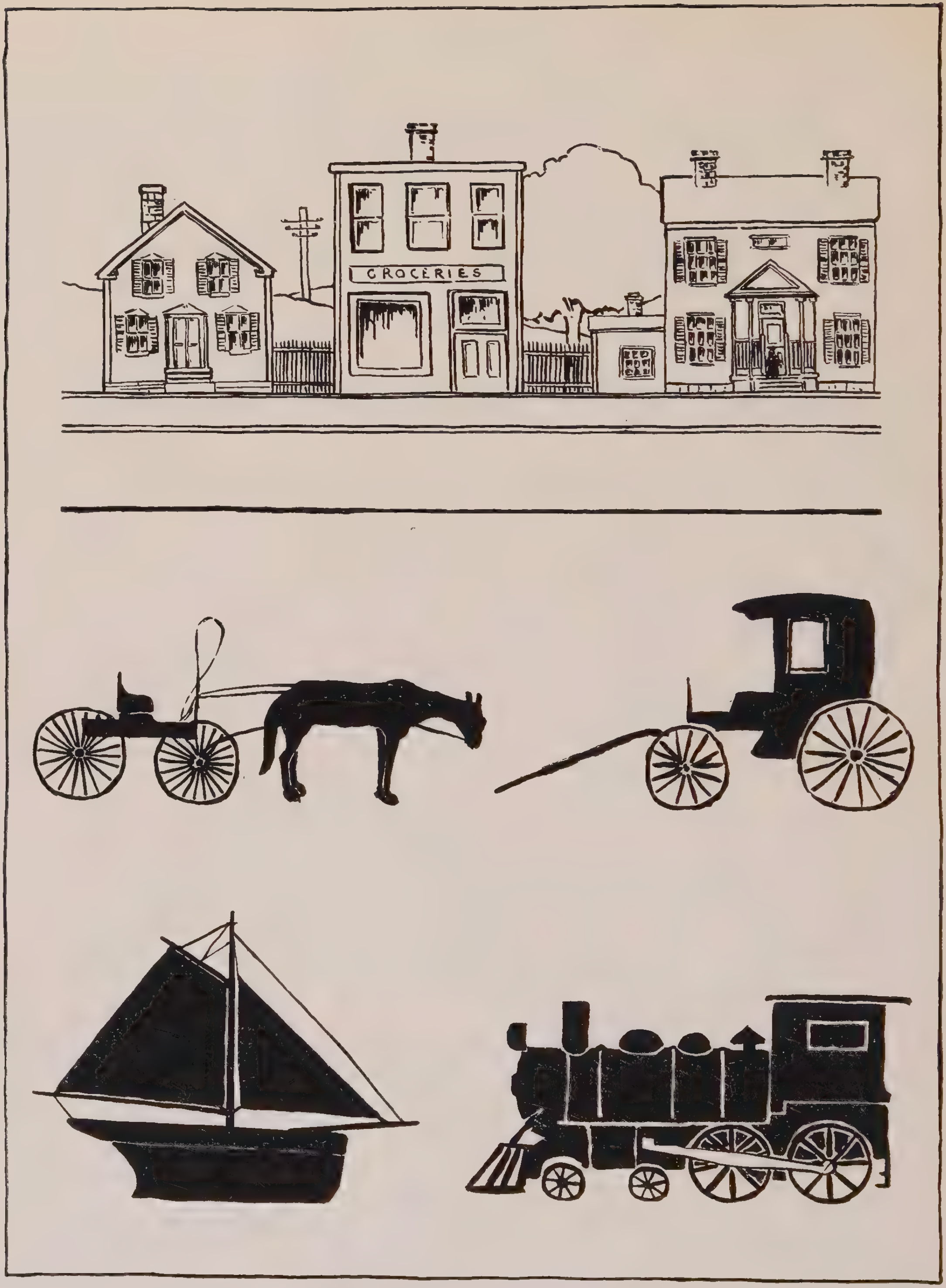


Plate 26. Houses in Outline — Toys in Silhouette

BEGINNING PERSPECTIVE

A knowledge of the laws governing the representation of the appearance of objects on a plane surface, called perspective, is necessary in order to represent (1) the third dimension of objects, and (2) the positions they occupy forward and back in a picture.

The plane of the paper, or the surface on which the drawing is made has two dimensions, length and breadth, and the representation of objects upon it has two dimensions; while objects and the relative positions which they occupy in space have three dimensions.

In its simplest form, perspective does not necessarily include a knowledge of scientific terms and principles, such as the use of eye level, vanishing points, etc., which are part of more advanced understanding of the science, but it does demand the power to judge and to express correctly sizes and shapes of surfaces, and the ability to represent these in their relative positions. Where surfaces do not show their real shapes they are said to be "foreshortened." Perspective has been called "the knowledge of the large and small, the near and the far." Therefore, in Beginning Perspective appearance is given by (1) correct relative position of objects, and (2) correct relative sizes of objects. In this simplest form of representation *involving perspective,* four facts concerning appearance must be remembered.

1. Relative position of surfaces is judged as above or below, to the right or the left of some fixed, known point in an object or its representation. This known shape, line, or point must be decided upon and the position and size of all other shapes, lines, and points constantly compared with it. It is called "a unit of measure."

2. All surfaces or edges farther away or back in the picture are relatively smaller than those nearer or in the front.

3. All nearer surfaces or edges, when in a position below the spectator, are placed lower down in the drawing than those farther away and the converse.

4. Shapes of surfaces must be perceived and represented without regard to the *facts* of the objects; in other words, objects are represented, not as they are known to be, but as they appear to be, as "objects of vision."

DIRECTIONS FOR DRAWING GROUPS OF FRUITS AND VEGETABLES

When two or more objects are placed together to form a unit, the result is a "group" which involves in its representation a knowledge of perspective in its simplest form.

1. Indicate by dots or small dashes the outside measures of the group, in order to show how much space the whole will occupy on the paper, *i.e.*, define the position of the whole group.

2. Sketch in the nearest object. This object serves as "a unit of measure" for the other objects in the picture.

3. Sketch in the other objects, determining their position by comparing them with the position and size established by the "unit of measure." That is, build up the drawing, "shape to shape." Remember that all measures are judged up and down, right and left, and that objects farther away are relatively smaller and placed higher up, than objects nearer.

EXERCISES

Groups of Fruits and Vegetables

Methods Note Book

1. Make an outline drawing in light pencil sketch lines of all edges of the objects, both seen and unseen. (Follow method for sketching as described in Beginning Drawing.) Reline in dark and light lines with sepia pencil or crayon ("artistic rendering") the seen edges. Begin with the nearest object. *Draw in "the table" or "foreground line."* Do not erase sketch lines.

Portfolio Drawings

1. "Mass in" with colored crayons, a group of fruit or vegetables, (follow directions for Beginning Drawing, by using an under color, etc.). Indicate the foreground line.

2. Make a finished drawing in crayons on colored paper which tones in with the prevailing color of the group. Frame down; represent the background or foreground in a darker tone of the same color as the paper (see directions on Arrangement, page 22).

3. Make a water color drawing of same group. Frame; indicate foreground line and arrange on mount of appropriate color.

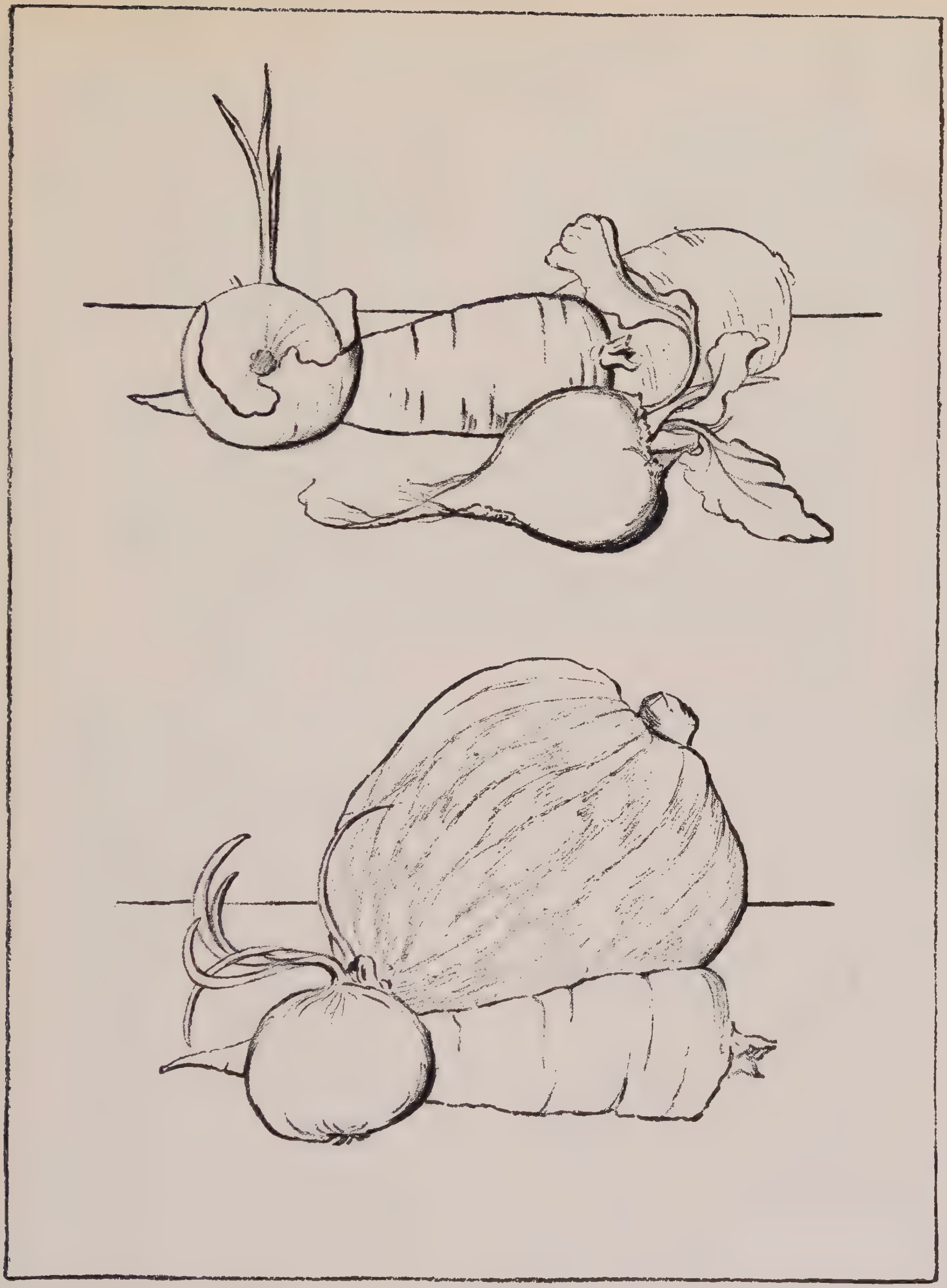


Plate 27. Groups of Vegetables

COMPOSITION OR PICTURE DESIGN

Story-Telling Illustration and Landscape Composition

The same laws of beauty and order which underlie the other forms of design control the art of picture making. The elements, such as people, houses, trees, animals, etc., which make up a picture, are oftentimes more varied and in themselves less closely related than those used in Decorative Arrangement or Natural Design, but they are all composed in the same way. There also enters into picture composition an element of realism and representation according to the laws of perspective, which makes design of this kind seem more difficult. In elementary forms of picture making, however, this feature should be eliminated as far as possible, and confined to the simple law governing relative sizes of objects to be drawn, such as: (1) objects far away are drawn smaller than those forward; and (2) the law governing relative position of objects, those back in the picture are placed higher up than those in front.

An illustrator considers the design of the picture first, the representation and drawing last. In composing a picture, consider the following:

Method I.

1. *Division of Area.* The area to be divided is made by frame lines and is usually a rectangle in shape. The frame lines should always be drawn.

The divisions of this area are called "foreground" and "background"; the former represents the horizontal plane upon which objects rest, the latter, the vertical plane against which they are seen. The line which makes this division of the area is called the "foreground" line.

In landscape composition the "foreground" is the ground, the "background" is the sky, and a third division is often added, called the "distance," which represents a vertical plane rising from the distant limit of the foreground and standing up against the sky. Still other divisions of the ground may be made by the introduction of a road, path, river, pond, etc. These should be drawn in such a manner that the areas are interesting in shape, well balanced, and rhythmic in proportion. The lines which outline the areas should be rhythmic and beautiful. [Principle Rhythm.]

2. *Placing of Interest.* The most important factor which may help to tell the story of the picture should be placed in such a position that the eye is kept within the picture and that the laws governing good design, balance, rhythm, and unity, are maintained. [Principle Dominance.]

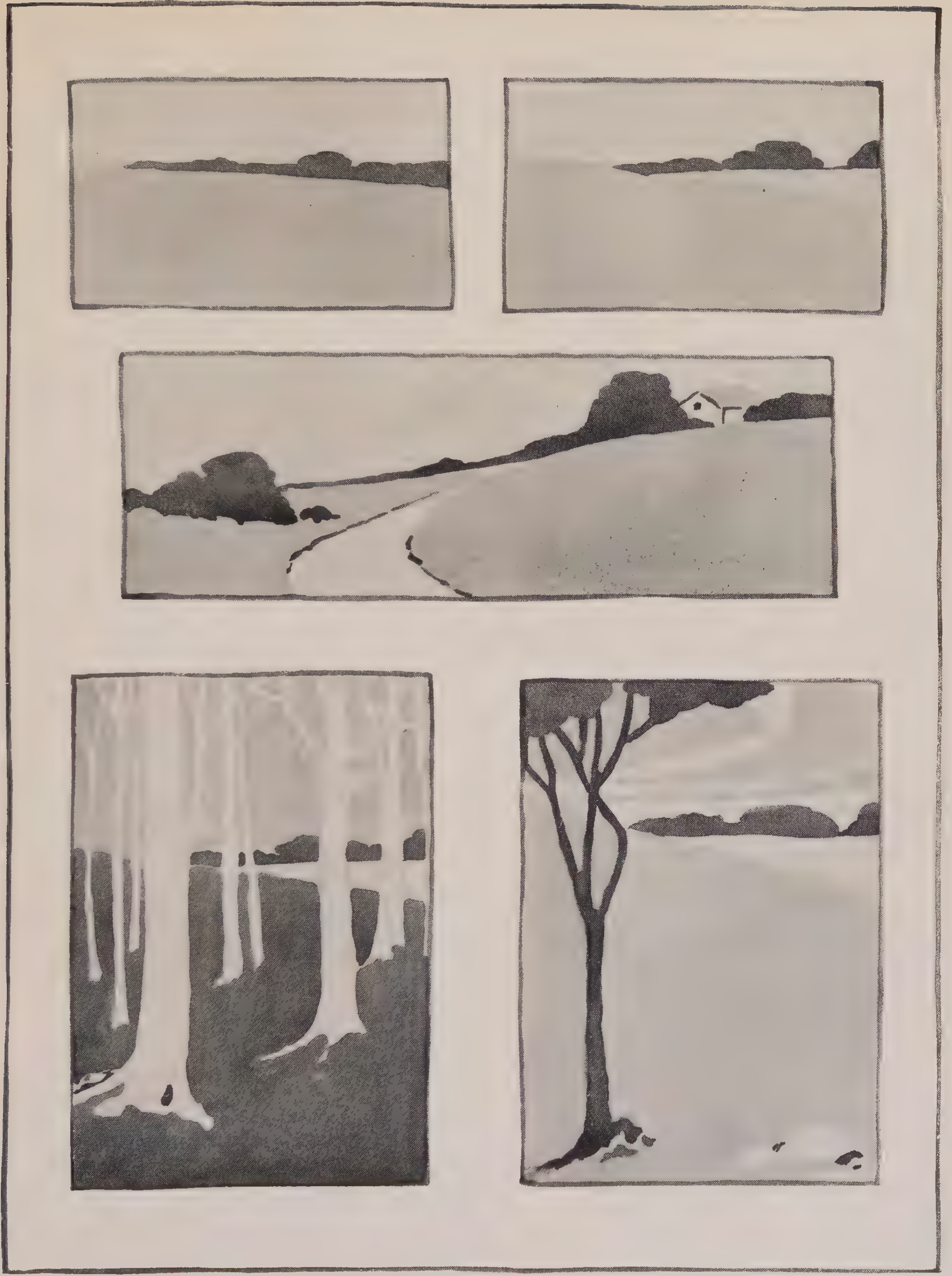


Plate 28. Landscape Composition

3. *Placing of Subordinate Interests.* The subordinate interests introduced to make clearer the story or for the sake of the composition should be so placed as to enhance the principal interest, and emphasize the laws of good design. [Principle Subordination.]

4. *Filling of the Area with Pattern.* The surrounding areas should be considered in relation to the objects of interests so that unity is maintained. A common fault in picture making by children is that of drawing small objects in large areas of space. The results are not pictures. [Principle Unity.]

Method II. The order of procedure may be reversed from that already given by drawing, first, the objects of interest; then, with an adjustable "finder," as in decorative arrangement, locating the best positions within the frame for these objects; and, third, dividing the background into areas according to principles of design. These areas may represent whatever is appropriate to the picture, and are called the "setting" of the picture, as a landscape, or an interior, etc.

By any method the result should be a well-ordered, balanced, and rhythmic arrangement of lines and areas within a frame, which may or may not represent some incident or story.

Directions for Picture Building with Cut-Outs

Method III. 1. Place cut-out in position on paper. Draw around it carefully with a sharp V.H. pencil held in a vertical position.

2. Find best position and best proportioned frame with an adjustable "finder," and draw the frame lines. Do not let the object rest on a frame line or be too low down in the picture.

3. Divide the space within the frame into well-proportioned areas to represent the foreground and the background of the picture. When more than one cut-out is used, place first the most interesting one, and center the interest around it, so that the other elements will be subordinate to this dominant interest. Then draw the frame and foreground lines, and add other elements if needed to bring unity and harmony into the design. Avoid a crowded or scattered composition, a "mixed up" effect.

Follow the laws which govern the placing of objects forward and back in the picture. Remember that objects further away are placed higher in the picture and are relatively smaller, so that an object intended to be behind another can never be lower in a picture than the one in front.

4. Tone or color all areas or objects. Color tones may follow nature or be conventional in their scheme. All tones must be kept flat and even, and of the right value and intensity to make objects keep their proper positions. Avoid too strong contrasts and crude, unrelated colors. (See Plate 29.)

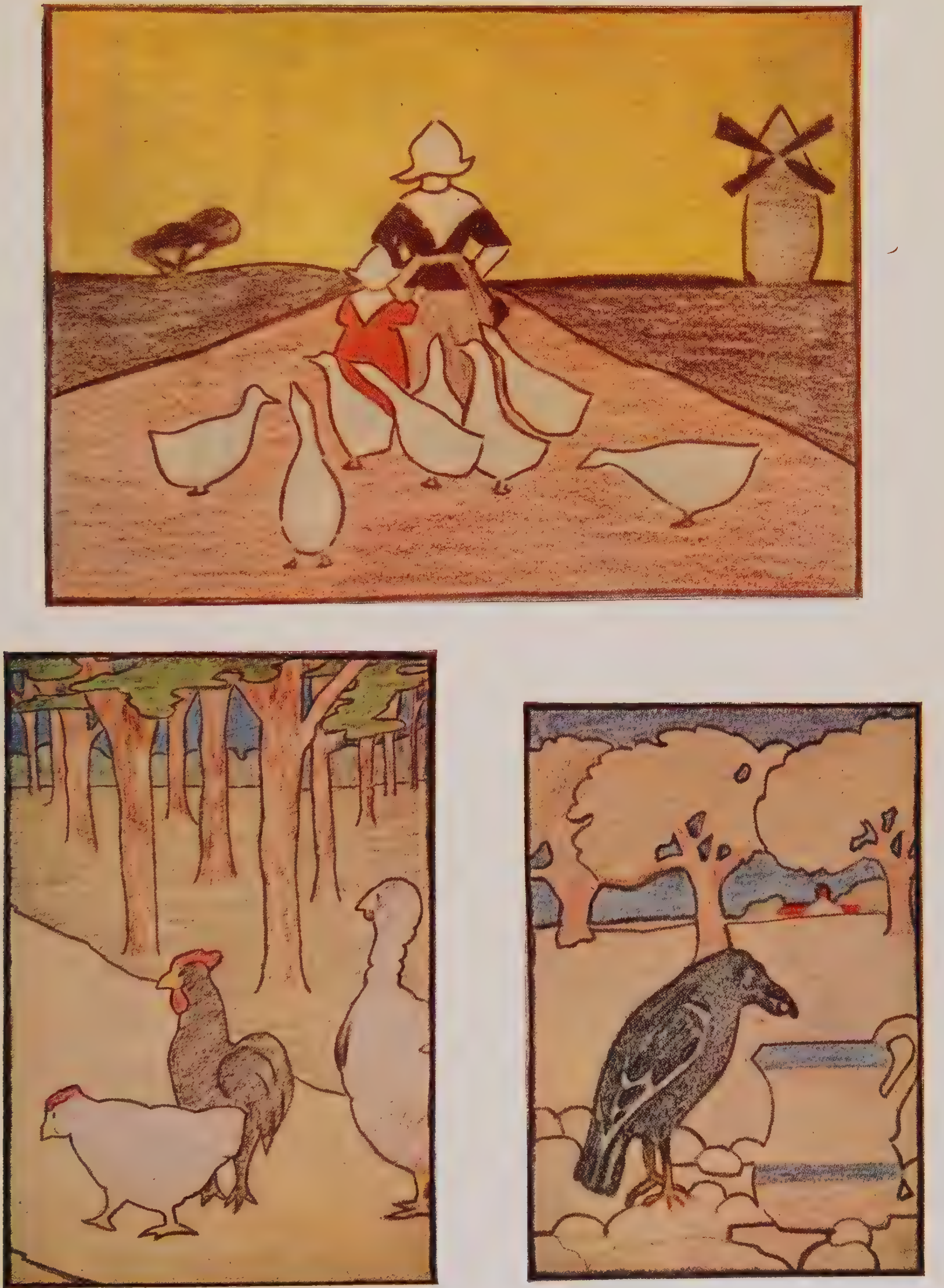


PLATE 29. STUDENTS' DRAWINGS — STORY ILLUSTRATION WITH "CUT-OUTS"

EXERCISES

Landscape Composition

1. Draw three horizontal oblongs. Divide by lines into foreground, background, and distance. (See Plate 28.)

(1) To represent level ground and distant trees.

(2) A hillside and distant water with distant trees beyond.

(3) A hillside with roof of house and distant trees.

2. Repeat above composition of lines in three vertical oblongs, varying the proportions.

3. Make tracings of landscape compositions from pictures or photographs.

4. Place tracing paper over line compositions and paint in three closely related values of gray.

5. Take one of the above compositions and divide the foreground by a receding path, road, or river. Place a tree, Fir, Maple, or Oak, in the foreground.

6. Take one of the above compositions and divide the whole area of the picture by tree trunks representing a wood-interior.

EXERCISES

Built Up Pictures With Given Cut-Outs—Flat Tone and Outline Drawing

Methods Note Book

1. Make a picture design with one cut-out. Tone with water color washes in three tones of gray (or black, white, and half-tone). Keep tones flat and outline the shapes carefully—add inside lines if necessary.

2. Make another design with the same cut-out. Tone with colored crayons, following the same arrangements of dark and light. Outline shapes in black or sepia pencil, and add inside lines if necessary.

3. Make composition with more than one cut-out. Paint figures in black ink silhouettes.

4. Make a composition in black paper cut-outs free hand. (Silhouette.)

PORTFOLIO DRAWINGS

1. Illustrate two or more scenes for a child story, in any of the above media. Select from:

    (1) Chicken Little.
    (2) The Three Bears.
    (3) Hiawatha.
    (4) The Town Musicians.
    (5) Any fable.
    (6) Our Foreign Cousins.
        - Dutch.
        - Eskimo.
        - Japanese.
        - Indian.

2. Build up a composition (Poster Picture) in given colored papers. Choose any one of the following combinations:

    (1) Two or three tones of blue with white.
    (2) Black, white, and one color.
    (3) Three tones of one color.
    (4) Two or three tones of one color and a contrasting color.

3. Trace a composition from an illustrated book in color, and copy same in the colored papers by mounting shapes on tracing. Select a picture from any of the following books (or others illustrated in same style):

    (1) Joan of Arc, by Boutet de Monvel.
    (2) Nursery Rhymes, by F. M. B. Blackie.
    (3) The Story of Simple Simon, by Frank Adams.
    (4) The Boy's Book of Indians, and The Wild West, by George Alfred Williams.

4. Make an original composition with the same colors as those used in built-up pictures from the illustrated books, No. 3.

ADVANCED PERSPECTIVE

In more advanced forms of drawing, a knowledge of terms used in the Science of Perspective and a familiarity with its principles, assist in making correct representations of the appearance of objects. It is useful for a teacher to understand something of this science as she cannot always see an object in the position in which each pupil sees it and therefore must be able, from her knowledge of principles, to distinguish an incorrect drawing and suggest a method for improving it. This knowledge is also useful in drawing an object from memory. Drawings made in this manner make an intellectual rather than an artistic or æsthetic appeal to the mind.

Terms Used in Perspective

In judging the appearance of objects the following planes are used:

1. The Picture Plane. The Picture Plane is a surface or plane, *parallel to the observer.* It might be represented by a window glass through which objects are seen. It is represented by the surface of the paper upon which the objects are drawn. It is therefore a *vertical plane parallel to the observer.*

2. The Eye-Level Plane. The Eye-Level Plane is a horizontal surface or plane which is at the height of the observer's eye, and at right angles to him. It is perpendicular to the Picture Plane. It is therefore a *horizontal plane at the eye level, perpendicular to the Picture Plane.* It is used to establish the position of the observer in relation to the object or horizontal surface to be drawn; this surface either coincides with this plane, or is *above or below it.*

3. The Central-Direction-of-Seeing Plane. The Central-Direction-of-Seeing Plane is a vertical surface or plane directly in front of the eye of the observer at right angles to him and is perpendicular to the Picture Plane. It is therefore a *vertical plane in front of the eye,* perpendicular to the Picture Plane.

It is used to establish the position of the observer in relation to the object or vertical surface to be drawn; this surface either coincides with this plane or is at *the right and left of it.*

4. The Center of Vision is a point of intersection of the Eye-Level Plane and the Central-Direction-of-Seeing Plane.

Before drawing the appearance of any object or surface establish your position in relation to it by asking the following questions, and observing the following conclusions:

1. Is the surface to be drawn parallel to you throughout its entire area, *i.e.*, is it parallel to the Picture Plane? If it is parallel to the Picture Plane it shows its real shape and true proportions. All measurements have to be made in this plane. When surfaces are perpendicular or oblique to this plane they are always *foreshortened.* A foreshortened surface is one which does not show its true shape.

2. Is the surface to be drawn in a horizontal position at right angles to you, perpendicular to the Picture Plane? If it is, it is *foreshortened* to a line at the Eye-Level Plane (its edge only is seen), and it is less and less foreshortened as it moves *up or down* from the eye level; *i.e.*, more and more of its surface is visible.

3. Is the surface to be drawn in a vertical position at right angles to you, perpendicular to the Picture Plane? If it is, it is foreshortened to a line at the Central Direction of Seeing Plane (its edge only is seen), and it is less and less foreshortened as it moves right or left from the center of vision; *i.e.*, more and more of the surface is seen.

Observe also the following in drawing objects. When drawing from objects place them high or at some distance away so that you are within good focusing distance. In other words, avoid drawing an object when placed near, unless it is also placed high.

PICTURE OF THE CIRCLE

Principles Governing the Appearance of the Circle

A Circular Surface appears as a circle only when it is parallel to the Picture Plane, and in no other position. When perpendicular or oblique to the Picture Plane it is foreshortened. When perpendicular to the Picture Plane it appears either as a straight line (its edge only is seen), or as an ellipse. It appears as a straight line when its position coincides with the Eye-Level or with Central Direction of Seeing Plane, and never in any other position. As it moves up or down, right or left of these planes, it becomes rounder and fuller, because more and more of the surface is seen; *but it never becomes a circle.* The farther edge of the ellipse appears flatter or less round than the one nearer the Picture Plane, because, as edges approach the eye level, they appear straighter. It is therefore always incorrect to represent the base of an object as a straight line when that object is below the eye level, because the lower the ellipse, the nearer it approaches the appearance of a circle.

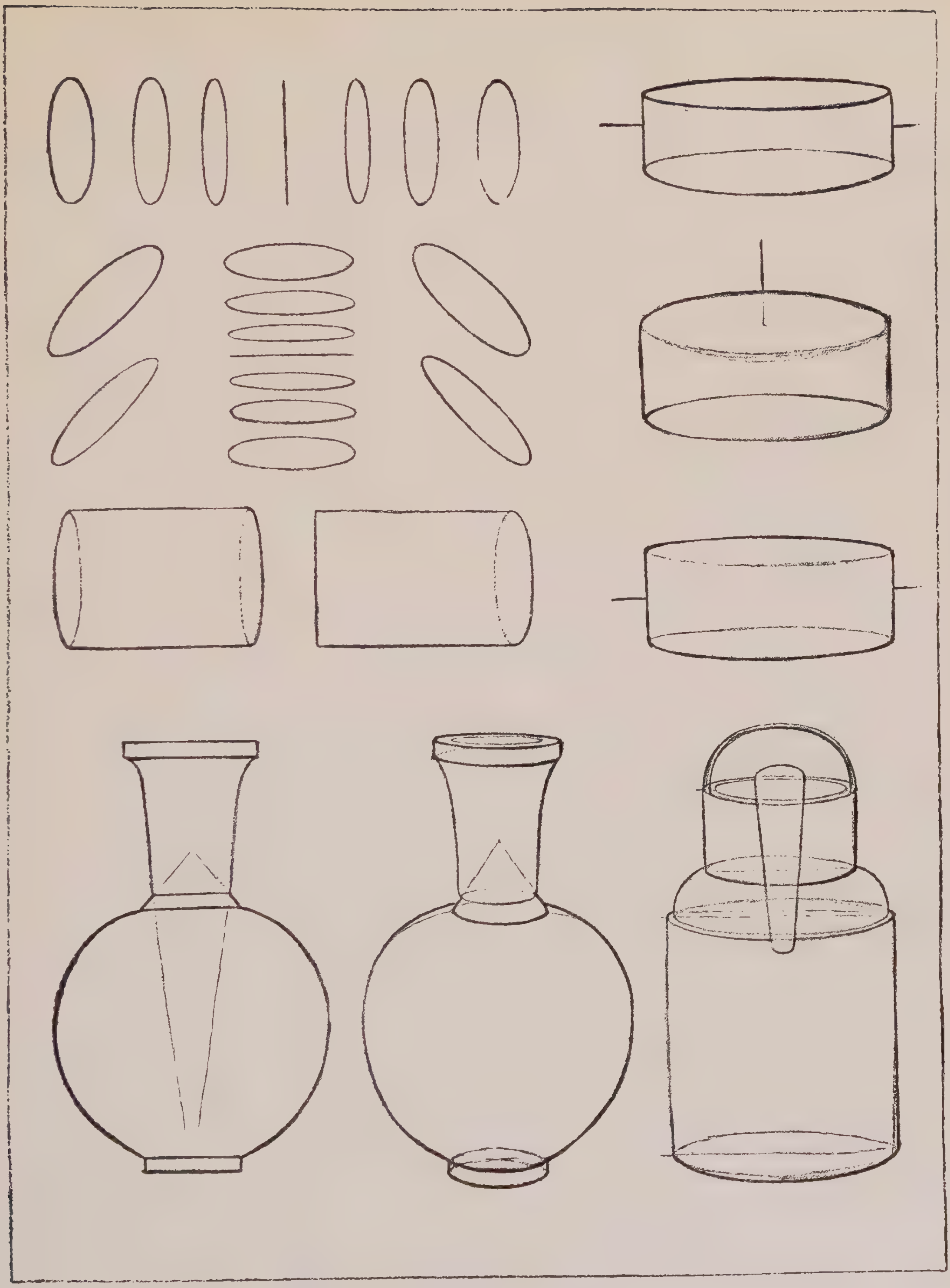


Plate 30. Foreshortening — Cylinder and Cone Principles

Directions for Drawing a Circle

Begin near the bottom of a circle and move pencil around toward the left without making a mark, repeat by drawing a light sketch line; reverse the direction, correcting any inaccuracy of the first sketch. Light curved lines may be placed before sketching in, to indicate the ends of the diameters.

Directions for Drawing an Ellipse

Indicate the ends and sides of the ellipse by light curved lines, or indicate the ends of the long and short diameters of the ellipse to establish the size of the figure. Begin near the center of the farther side or back edge of the ellipse and move pencil around *toward the right* without making a mark; repeat by drawing light sketch line; reverse the direction, correcting any inaccuracy of the first sketch. Do not draw the diameters or begin at the ends of the ellipse to draw the figure.

PRINCIPLES GOVERNING THE APPEARANCE OF CONCENTRIC CIRCLES

When one circle is seen within another, with centers the same, they are concentric, as the bottom of a cup within a saucer. When the circles are not parallel to the Picture Plane they appear as ellipses. Since the *long diameters* of the ellipses are *parallel* to the Picture Plane, they are not foreshortened; therefore, the distance between the ellipses at those points is the exact distance. All other distances between the ellipses are less, *i.e.*, are foreshortened, and therefore do not show the real measures. The perspective center of an ellipse appears to be back of an exact center, because the rear half appears more flattened out than the front half, and therefore is drawn narrower.

In drawing concentric ellipses observe the following:

1. The apparent center of the ellipse is not the real center.
2. The diameter of the smaller ellipse is higher up, above that of the larger ellipse.
3. The space between the ellipses is the real distance only at the ends of the long diameters.
4. The space between the ellipses is smallest at the ends of the short diameters, and smaller at the back or farther half, than at the front or near half. In certain positions the farther edges of these ellipses seem to coincide.

EXERCISES

Ellipses and Concentric Ellipses

Methods Note Book

1. Draw the appearance of a circle in the following positions:

(1) In a horizontal position at different levels.

(2) In a vertical position at different distances from the Central-Direction-of-Seeing Plane.

(3) In an oblique position at the right and at the left.

(4) In a position parallel to the Picture Plane.

2. Draw the appearance of concentric circles in three different positions.

3. Draw a diagram showing the reasons why the exact center of an ellipse is not the perspective center; and why, in concentric ellipses, the smaller the circle, the farther up the center will appear.

GENERAL DIRECTIONS FOR DRAWING OBJECTS IN PERSPECTIVE

Methods Note Book

1. Establish your position in relation to the object and find your eye level and center of vision.

2. Establish the position of the object on the paper, using light dashes to indicate its proportions.

3. Sketch in the shape lightly in two dimensions.

4. Sketch in lightly the appearance of all surfaces, both visible and invisible edges, as if the objects were made of glass.

5. Reline in dark and light lines the visible edges only, leaving all the sketch lines. (Sepia pencil or crayon may be used for the relining.)

EXERCISES

Objects Based upon the Cylinder

Methods Note Book

The straight sides of cylindrical objects are tangent to the horizontal diameters of the ellipses, and these diameters are always at right angles to the vertical diameters.

1. Three outline drawings in pencil of a cylinder, in the following positions:

(1) Below Eye-Level, standing on its base.

(2) Above Eye-Level, standing on its base on a shelf.

(3) Eye-Level at center of face, standing on its base.

(4) Left base coinciding with Central Direction of Seeing, resting on its face.

(5) Central Direction of Seeing in the center of the face.

(6) One cylinder with base parallel to the Picture Plane with Center of Vision in center of base; another cylinder with one end resting on the ground, the other on the first cylinder; bases perpendicular to Picture Plane.

PRINCIPLES GOVERNING APPEARANCE OF CONICAL SHAPED OBJECTS

In objects with slanting or curved sides the profile edges (outside edges) are not tangent to the ends of the diameter of the ellipse which represents the base (as in cylindrical objects). They are tangent to the *edges* of the *ellipse* either in front or behind the *ends* of the diameter.

If the sides of the object are extended to form a cone, it will be found when the apex of the cone is farther away from the level of the eye than the base, that the sides appear to join the base so that *less than half way* around the base is seen (*i.e.*, the sides of the cone appear to come forward and hide the ends of the ellipse). The converse is also true, when the apex of the cone is nearer the eye level than the base, the sides appear to join the base so that more than half way around the base is seen (the sides of the cone appear to recede and show the ends of the ellipse). That is to say, the points of tangency of the sides and base change and move forward and backward on the edge of the ellipse which represents the base, and give the effect of roundness to the drawings of objects of this character.

PRINCIPLES GOVERNING THE APPEARANCE OF OBJECTS WITH CURVED SIDES: VASES, CUPS, PITCHERS, ETC.

As a result of the "cone principle" the profile edges of objects with curved sides appear to move forward or backward when placed either above or below the eye level. The only position in which the apparent edge of an object is its real edge is when it is directly opposite the eye. That is to say, the boundary line which marks the limit of our vision recedes or advances according to: (1) the slant of the side, and (2) the direction and distance that it is from the eye level.

In a vase or object below the eye level, we see more than half way around when the sides curve out, and less than half way around when the sides curve in.

EXERCISES

Objects Based on the Cone Principle

Methods Note Book

1. Draw a cone in three different positions, mark points of tangency of base with sides.

2. Copy front view of vase from chart in light pencil lines, showing shape and proportions. Draw its appearance as follows:

(1) Consider vase as below eye level.

(2) Draw in ellipses.

(3) Extend sides of vase to form cones and mark points of tangency of ellipses with sides.

(4) Draw boundary lines out or in, up or down, as necessary.

(5) Draw the thickness of the rims.

(6) Reline visible edges.

3. Draw from object, following same method as in No. 2.

PRINCIPLES GOVERNING THE APPEARANCE OF ATTACHMENTS: AS HANDLES, SPOUTS OF TEA-POTS, ETC.

1. Directions for drawing ears for attaching bails to pails, tea-pots, etc. (See Plate 31.)

(1) Draw an ellipse through the point on the surface where the ear joins the jar.

(2) Draw the vertical and horizontal diameters of the ellipse, to find apparent center of ellipse.

(3) Draw axis from the point of attachment of the ear through the center of the ellipse to the other side of the ellipse. This will give the position of the other ear. Draw the bail.

2. Directions for placing handle on surface of pitchers. (See Plate 31.)

(1) Draw vertical central axis of pitcher, which coincides with Central Direction of Seeing and is therefore a straight line.

(2) Draw a series of lines approaching its profile edge, the real (not apparent) contour of the pitcher.

(3) Place the position of the attachment of the handle on one of these lines.

(4) Draw in the curve of the handle; notice its shape and the effect of the *twist* in its edges as it comes toward the center of the vase.

3. Directions for drawing a spout of a tea-pot.

(1) Draw the circle or the ellipse as the case may be for the position of the spout on the tea-pot (where the spout joins the tea-pot).

(2) Draw axis from center of this ellipse to top of spout. Notice the slant of this axis and its height (position) in relation to the top of the tea-pot.

(3) Sketch in the shape of the spout on these lines.

4. Directions for drawing the lip of a pitcher.

(1) Draw an axis from the center of the top of the handle through the perspective center of the top ellipse of the pitcher.

(2) Extend this axis beyond the top the length of the lip.

(3) Mark off on the top ellipse, each side of the axis, the width of the top of the lip. Remember that the half nearest the end of the ellipses is more foreshortened than the half further around on the ellipse and is therefore shorter.

(4) Sketch in the top edge or curve of the lip.

(5) Define the position of the profile edge of the lip on the surface of the pitcher by drawing a line in the same direction as the profile edge of the pitcher, and place the extremity of the lip, where it joins the pitcher, on this line. This line will be the same as that upon which the handle was drawn only on the opposite side of the pitcher.

(6) Draw the profile edge of lip.

Directions for Drawing Group of Cylindrical Objects

When the objects are placed in a group, they must be drawn so that no two objects are occupying the same space, *i. e.*, room must be left for thickness of each object. To prove that this is done, draw,—

1. An ellipse through the widest part of each object.

2. Draw the long diameters in the ellipses and drop perpendiculars down to the ground from the ends of the diameters.

Draw the ellipses on the same plane (on the ground), and see that they do not overlap each other. (See Plate 31.)

The further side of the horizontal plane (the table) upon which the objects rest, is represented by a foreground or table line. This line, which divides the horizontal plane from back vertical plane, must be placed higher up than the farther side of the ellipse in order to be farther back than the back edge of any object.

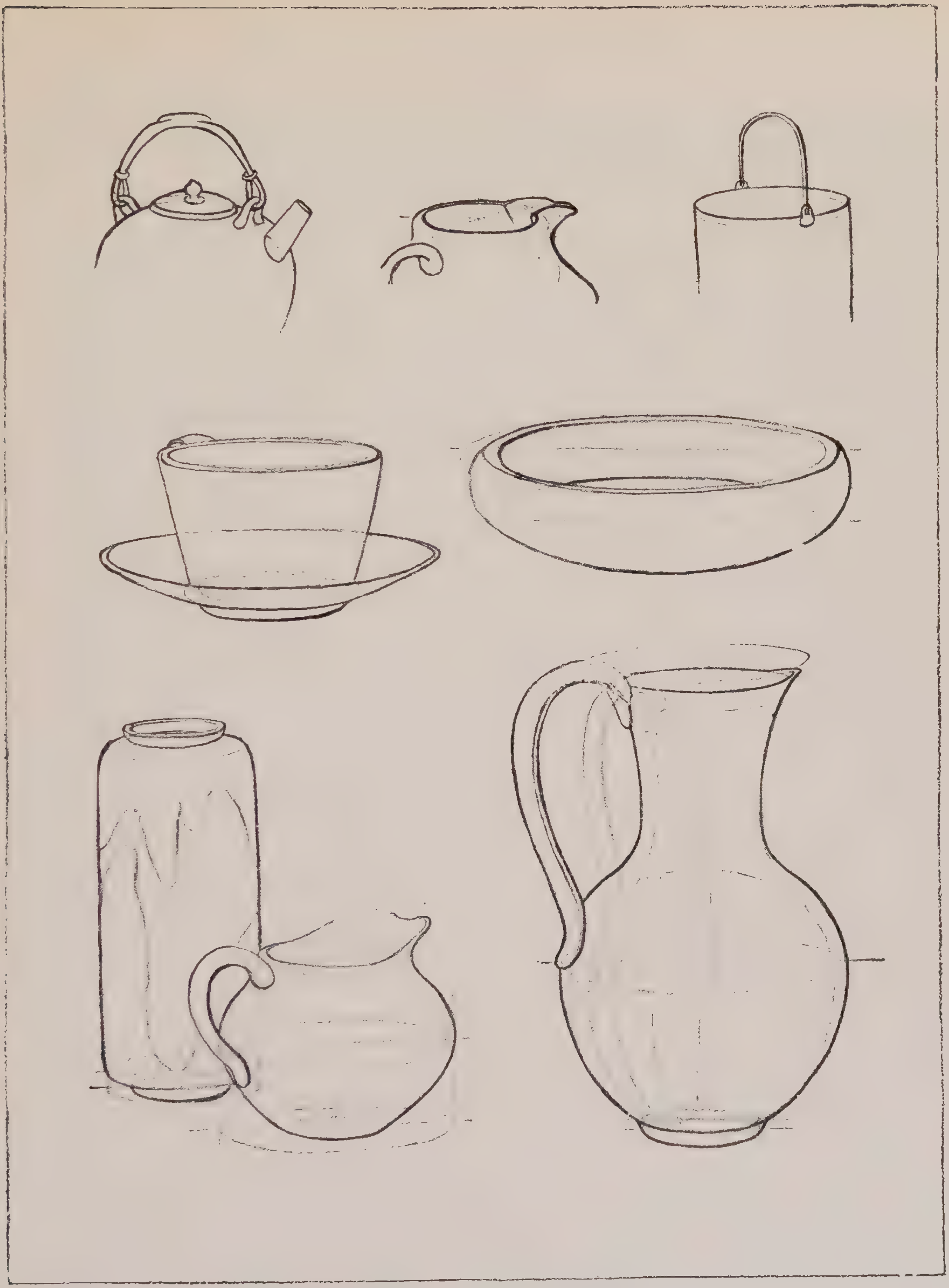


Plate 31. Grouping of Cylindrical Objects

EXERCISES

Cups and Saucers, Tea-Pots, Pitchers, Vases, and Common Objects of This Type

Methods Note Book

1. Cup in a saucer below the Eye-Level, with handle of cup one-third around towards the front.

2. Tea-pot with spout and handle and cover.

(1) Below Eye-Level, spout directly in front.

(2) On a shelf, above the Eye-Level, spout one-quarter way toward the front.

3. Pitcher with lip one-quarter around toward the back, below Eye-Level.

4. Saucepan with handle.

5. Saucepan or pail with bail.

6. Group of two lemons and tumbler half full of water.

Portfolio Drawings

Cylindrical and conical objects:

1. Draw a piece of pottery in colored crayon on colored paper the dominant tone of the object.

2. Draw on white paper, with brush and ink, a piece of pottery, representing the shadow-shapes only.

3. Draw on black paper in white chalk same object, drawing in high light and half-light-shapes only.

4. Draw a shallow dish or plate in sepia pencil showing inside rim and bottom.

5. Draw group of objects in sepia pencil, and frame down to form a pleasing composition. Tone in either background or foreground by drawing parallel lines with the pencil.

6. Draw group of pottery in colored crayons on colored paper the dominant tone of the group. Frame down the same, using adjustable finder, to form a pleasing composition. (See Picture Design.) Tone in the objects in flat tones, and outline in black or brown crayon. (Flat Tone and Outline Drawing.)

7. Place tracing paper over No. 5 and paint in two or more tones of one color with black and white.

8. Draw a cup and saucer with tea-pot and pitcher in sepia pencil.

9. Use any objects drawn and compose an advertising poster for a "Tea-Room," Church Supper, Cook Book Cover, etc.

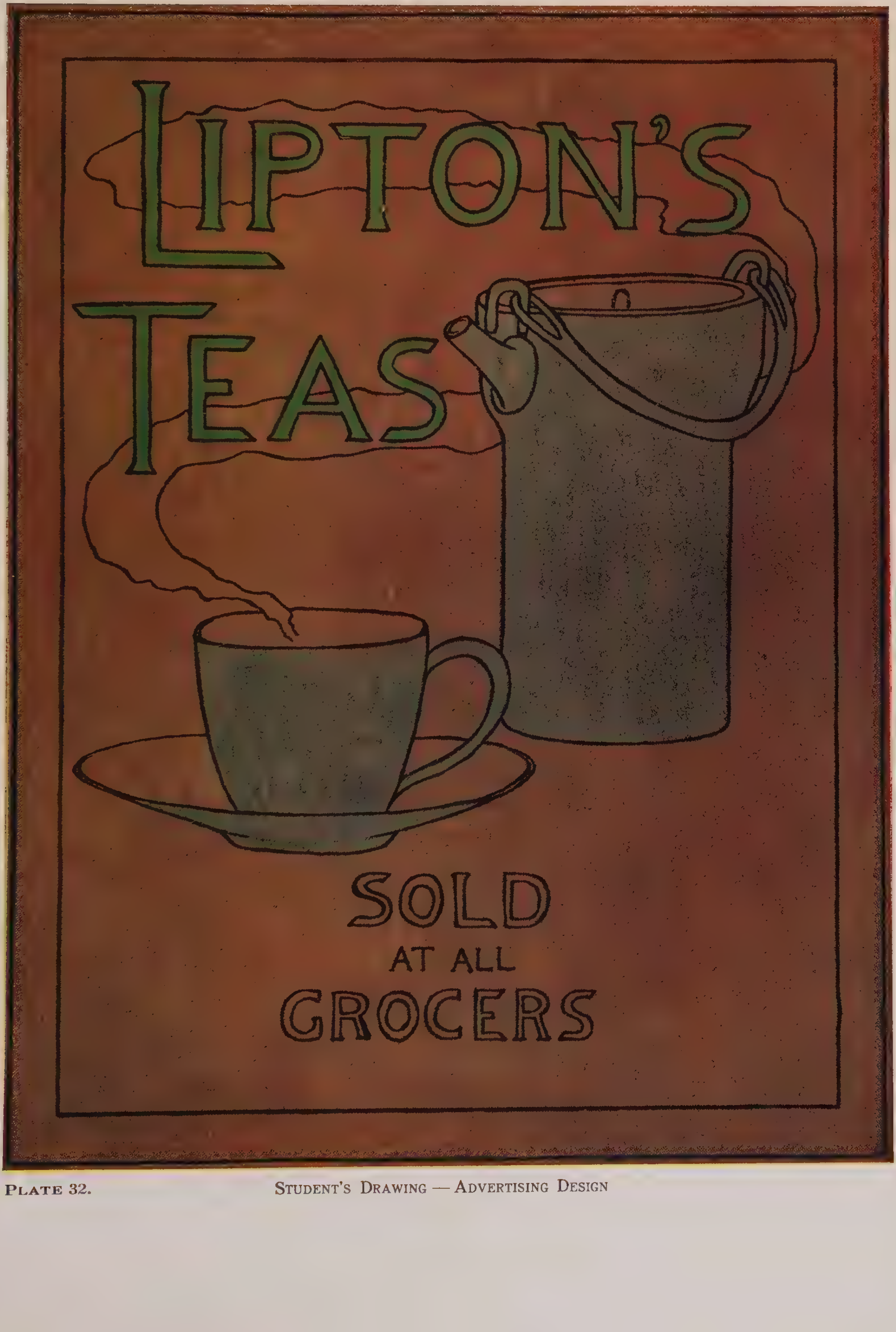


PLATE 32. STUDENT'S DRAWING — ADVERTISING DESIGN

DIRECTIONS FOR PLANT DRAWING

I. Selection and Preparation of Material

1. Select appropriate subjects with some element of beauty.

2. Place specimen in good position on the same size paper as that upon which drawing is to be made. Place the specimen with stem starting near or from the edge of the paper; with berries, flowers, etc., not too near the top or edges of the paper; axis of specimen in harmony with axis of paper; leave room for top or "growing end" of specimen.

3. Avoid a position which shows leaves, etc., growing out from each side of the stem at regular intervals, or hanging down from one side of the stem, like clothes upon a line. Such effects might be drawn for scientific purposes, but are not beautiful. Turn the specimen so that some leaves, flowers, or berries cover the stem and break a long-stem effect.

4. If necessary, to avoid confusion, remove parts of the specimen, but do not produce a too thin effect by so doing.

5. Prepare the paper upon which the drawing is to be made by cutting it the right proportions, not tearing it.

II. Method of Drawing a Nature Spray

A. In Outline

1. *Placing.*—Draw in lightly in the correct place on the paper the growth of the specimen, *i. e.*, stems and branches; center veins of leaves; large shapes, like fruit. Do not draw side veins of leaves.

2. *Size and Shape of Parts.*—Sketch in the general shape of the parts, as leaves, flowers, etc., in the same way, noticing contrasts in size as well as shape, and especially the position of each part in relation to the other parts, *i. e.*, how near one another. Observe the following directions when drawing foreshortened leaves and flowers:

(1) Foreshortened leaves.

A. Draw center veins to establish attitude.

B. Draw shapes—

Notice shape of each part. The edges where the leaf turns over is usually a straight line, and the turned over part a triangle or a variation of a triangle in shape.

(2) Foreshortened flowers.

A. Draw approximate shape of flower.

a. When seen in side view a flower often resembles a triangle.

b. When seen in 3/4 view it resembles a combination of a triangle and ellipse, or two ellipses. (See Plate 33.)

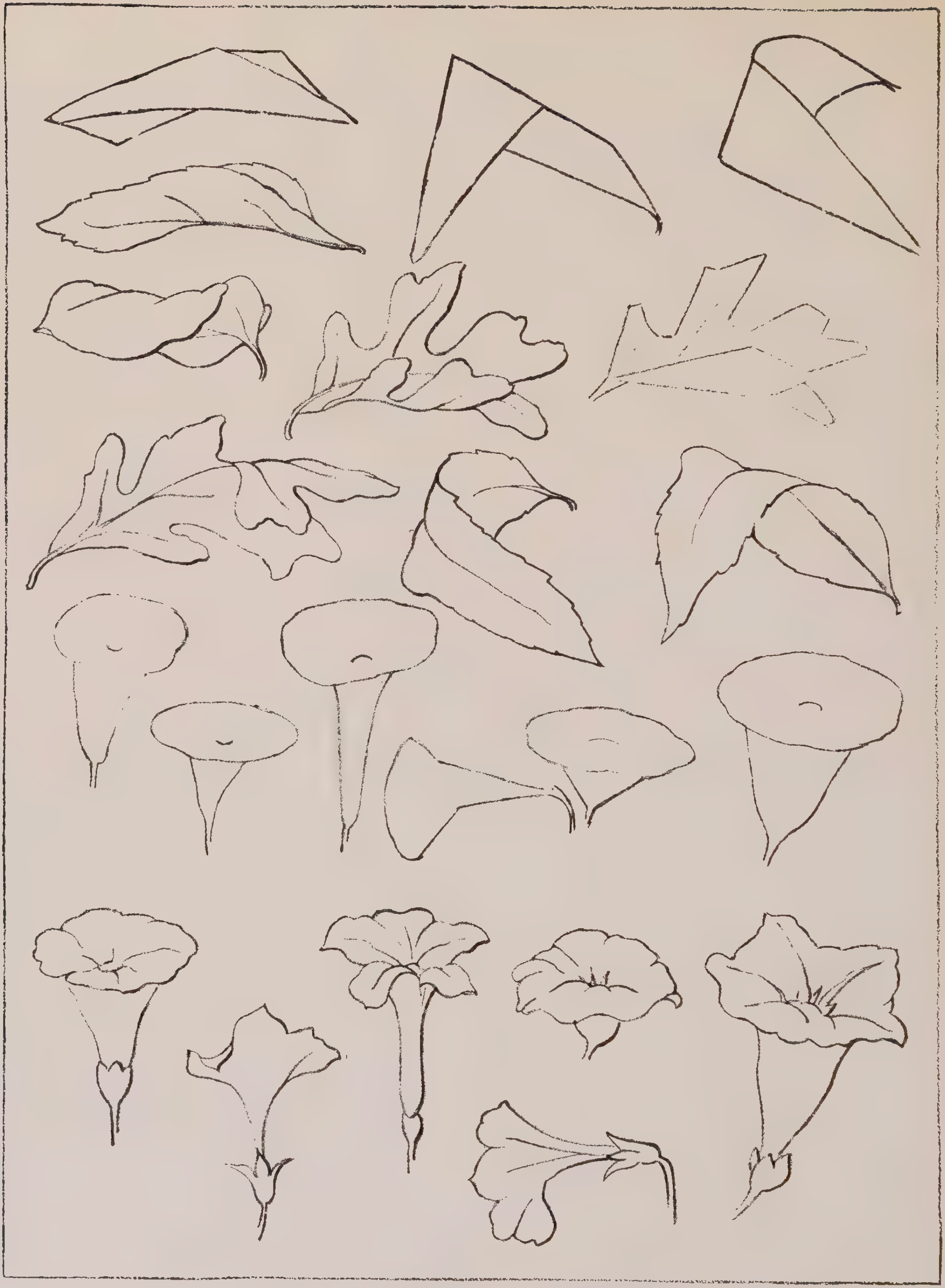


Plate 33. Foreshortened Leaves and Flowers

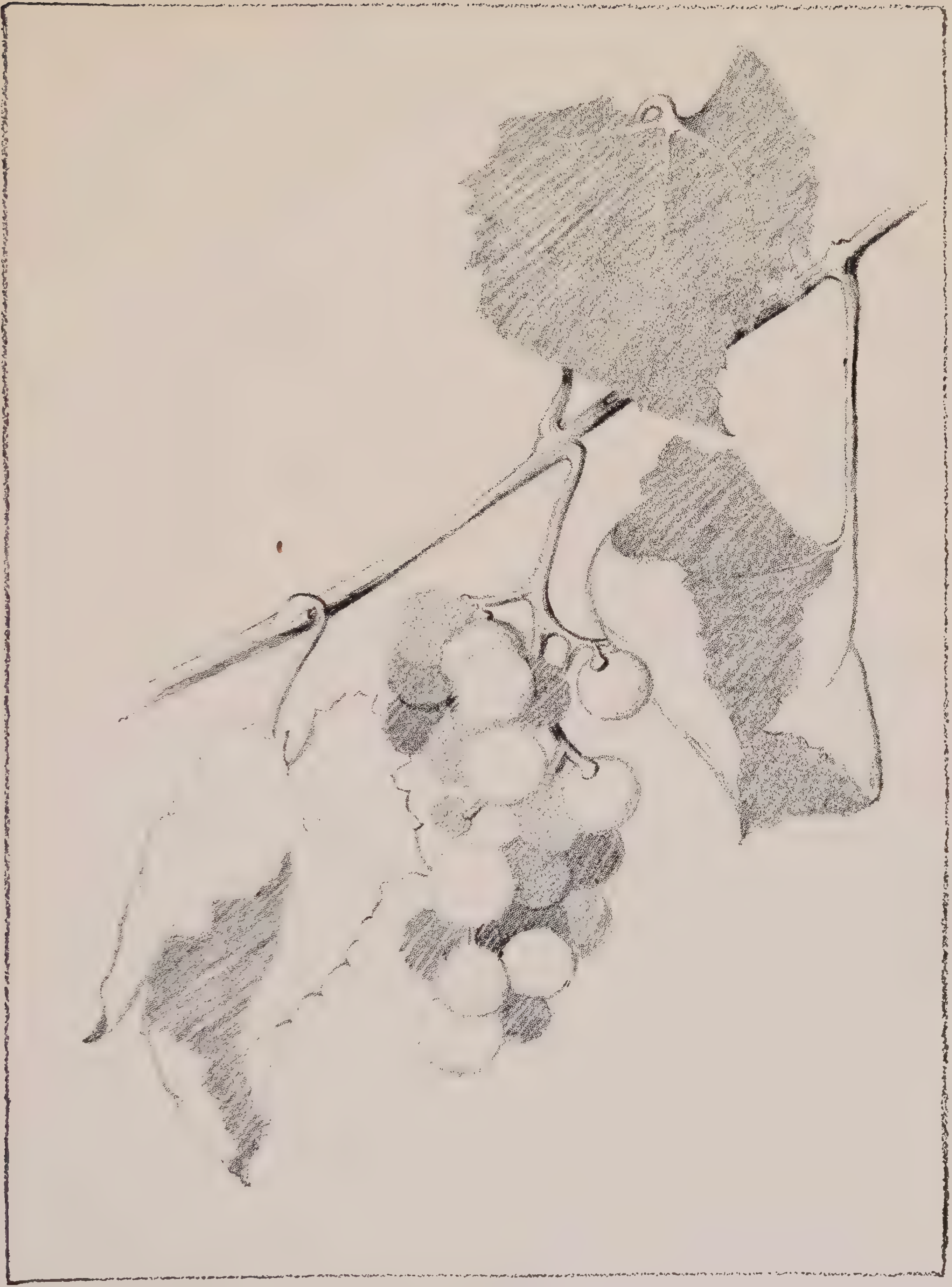


Plate 34. Nature Drawing — Dark and Light

c. When seen in top or face view it resembles a circle.

B. Indicate the center. Its apparent center varies in relation to its foreshortened position. (See Plate 33.)

C. Draw the petals within the approximate shape. Notice their length, width, and shape.

B. IN TONE

1. *Dark and Light Color Values.*—Sketch in lightly, as for outline drawing, showing placing, size, shape, and position of parts, and indicate by a light sketch line changes in contour. Have the specimens so placed that broad effects of dark and light are seen; as, upper side of leaves dark, under side of leaves light, etc. Do not look for shadow or for variations in the general effects. Show these broad effects by an even tone made with a medium soft, broad-pointed lead or sepia pencil, or crayon. An even tone is made by parallel lines slanting in one direction. Be careful to keep the contour as indicated, but do not outline the contour in a tone drawing.

2. *Shadow (Light and Shade).*—After the color values of dark and light are done, a darker dark may be added, or a light taken out where plainly seen. This dark has shape, often following the contour of the object, and is shadow.

In elementary drawing add shadow only to round parts, as stems and fruits.

C. IN COLOR

1. *Variation in Hue.*—Express variation in color hues as seen in the specimen by drawing in with the dominant color, as orange or yellow for subjects with leaves, and adding the "local color," as green.

2. *Variation in Value.*—Express the dark and light effects of the hues by diminishing the quantity of the color used, if for light; and by adding the complement of the color, or some dark color, for dark.

3. *Variation in Intensity.*—Express bright and dull effects by keeping the color clear and strong for bright, and adding the complement for dull.

The parts nearest to the observer and illumined parts are usually the brightest.

A good colored drawing expresses these three qualities: Variation (1) in hue, (2) in light and dark, (3) in intensity of the colors.

When crayon is the medium used these effects are produced by placing one color over or beside another. When paint is the medium used, these effects are produced by delicate mixing, either on the paper or before applying to the paper.

EXERCISES

Plant Drawing

Make series of drawings of one subject, using a different specimen for each study or the same specimen in different positions.

1. Pencil outline drawing: careful exact line in placing details of structure; foreshortened (turned over) leaves; flowers in various positions, showing full view, side view, etc.
2. Spray in pencil outline (artistic rendering).
3. Spray in dark and light gray tones in water color.
4. Same as No. 3, in sepia pencil, or broad-lead pencil.
5. Spray in color—crayons.
6. Spray in color—water color.

USES FOR PLANT DRAWING

There are two purposes for which a knowledge of plant drawing is useful:

I. Scientific

A good drawing for scientific purposes should show accurately and plainly all the facts concerning the subject—definite seeing and drawing of details. Nothing should be added (like shade lines) which does not help to make facts clearer. (Shading is often put in to cover up careless, indefinite seeing.) Good results depend largely upon:

1. Good arrangement on sheet.
2. Firm, hard pencil (or ink) outline of forms, made on smooth paper, with a sharp-pointed pencil (or pen).
3. Knowledge of the facts which are to be shown.
4. Definite seeing.
5. Judgment in selection and position of the specimen used.

II. Decorative

Seeing directions on design and composition.

PRINCIPLES GOVERNING THE APPEARANCE OF OBJECTS WITH STRAIGHT LINE EDGES, BASED ON THE CUBE, PRISM, ETC.

There are three methods used to assist in representing the appearance of objects which are based upon the cube and prism, objects like books, houses, boxes, chairs, etc.

1. By establishing points in relation to a known point or line, such as a vertical edge nearest the Picture Plane, which is also "the unit of measure."

2. By establishing the size of the angles and slant of the edges nearest the Picture Plane; that is, establishing the slant of the "key lines," and finding the other edges in relation to these lines.

3. By knowing the principles which govern the convergence of lines and by establishing correct vanishing points for these lines.

In drawing from objects of this character, it is necessary to employ all these methods. Draw first by one, test by another, and correct by the one which helps the most to make the drawing "look right," which, after all, is the best test, provided the sense of vision has been developed.

DIRECTIONS FOR DRAWING STRAIGHT LINE OBJECTS

When some edge in the object is in a vertical position:

Method I.—By establishing points: Upper Drawing, Plate 35.

1. Draw the "measuring unit." This is the edge nearest the Picture Plane.

2. Establish the proportions of the vertical faces.

3. Fix the corners of the object, right and left, up and down, in relation to the measuring unit.

This may be done by holding the pencil at arm's length in a horizontal or vertical position parallel to the Picture Plane (therefore parallel to you, neither tipped toward you nor away from you), and establishing—

(1) The position of the points in relation to the "unit of measure."

(2) The measures between the points compared with the "measuring unit." Light horizontal and vertical sketch lines may be drawn through points to assist in establishing other points.

Pencil Measurements must be made in a plane parallel to the Picture Plane, right and left, up and down, and are measures that are in propor-

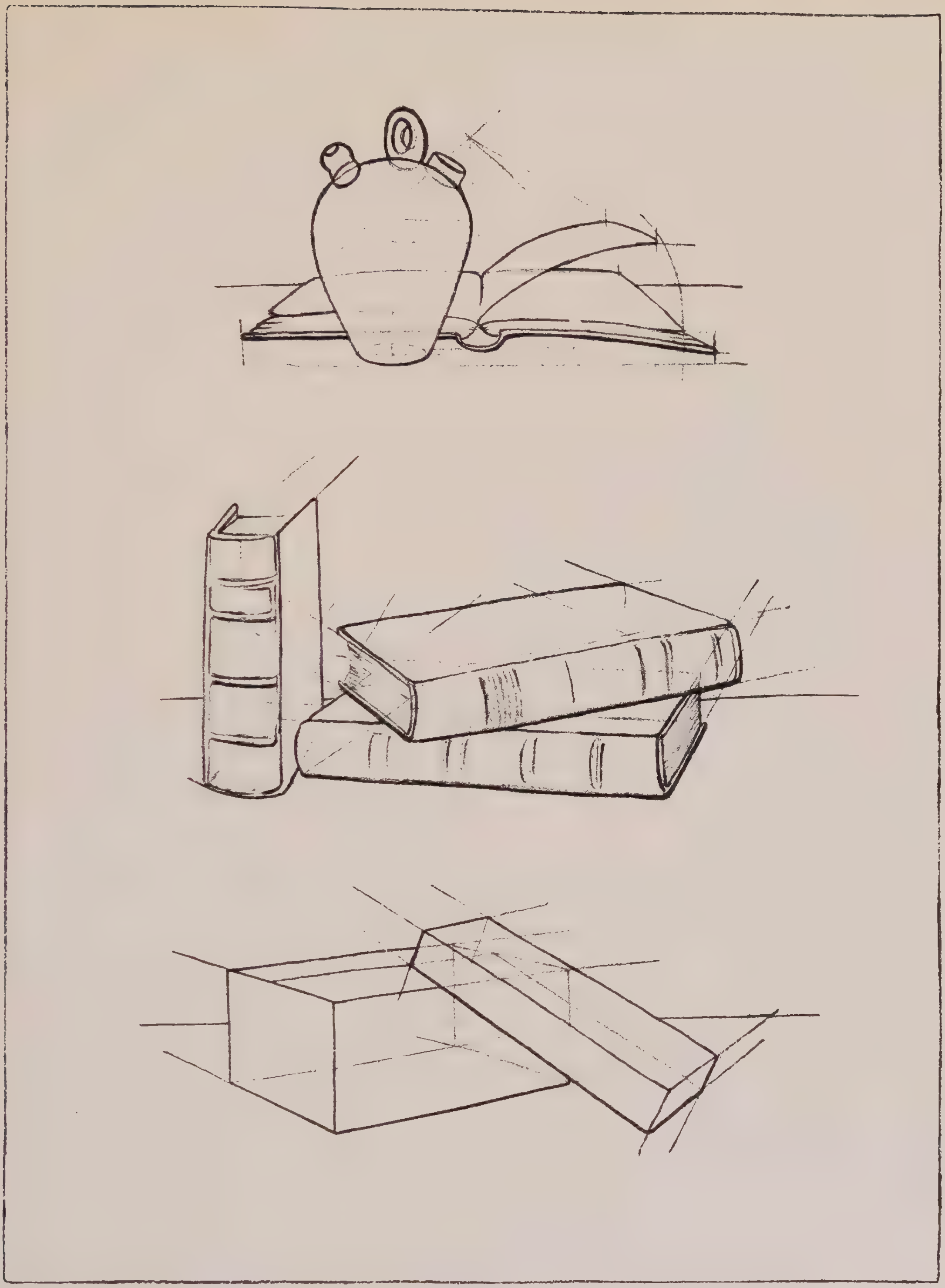


PLATE 35. CONVERGENCE

tion to the real measures of the object but are not the measure of the drawing to be made.

Method II.—By establishing "key lines." Center Drawing, Plate 35.

The "key lines" are the receding edges of the object, which are the least foreshortened; they are the edges which are nearest the Picture Plane, and at the same time nearest the Eye-Level Plane and go back into the picture from the point nearest to the Picture Plane.

1. Draw the "unit of measure."
2. Establish the slant of the "key lines."
3. Establish the proportions of the vertical faces.
4. Find the slant of the other receding parallel edges in relation to the "key lines" already established.

(1) Remember that the farther edges are shorter than those nearer the Picture Plane;

(2) That edges which coincide with the Eye-Level Plane or Central Direction of Seeing Plane, are foreshortened to a straight line, even if, in the object, they are at right angles to one another:

(3) That the nearer the edges are to the Eye-Level Plane, the less they slant; and conversely, the further removed from the Eye-Level Plane they are, the more they slant, that is, the steeper the slant:

(4) That the less that is seen of the face of the object, the more the receding edges of that face appear to slant; that is, the smaller the face is in proportion to its real measure, the steeper the slant. The converse is true. The more of the face of the object that is seen, the less is the slant.

Method III.—By establishing vanishing points of receding parallel edges. (See Plate 37.)

1. Draw the "measuring unit."
2. Establish the position of the Eye-Level, Central Direction of Seeing Planes, and in some cases auxiliary planes parallel to the Central Direction of Seeing Planes.
3. Establish the slant of the "key lines."
4. Find the vanishing point of receding parallel edges.

The vanishing point is located or its position is imagined by extending to indefinite length a key line, and then extending the line, which in the object, is parallel to the "key line." Where these lines intersect is the location of the vanishing point.

5. Draw all lines representing parallel edges in the object to the same vanishing point.
6. Complete drawing by adding necessary vertical edges to establish shape and proportion of surfaces.

The following principles governing the appearance of parallel, horizontal edges, must be remembered:

1. All receding parallel horizontal edges appear to converge to the same point on the Eye-Level.
2. When below the Eye-Level they appear to converge upward toward the Eye-Level.
3. When above the Eye-Level they appear to converge downward toward the Eye-Level.
4. The nearer they are to the Eye-Level, the less they slant, and the converse.
5. All vertical edges in the object are drawn as vertical lines.
6. Edges, which in the object may be at right angles to one another, appear as one line at the Eye-Level.

(Example seen in rows of windows on the two sides of a house, which appear on a line when they coincide with the Eye-Level Plane.)

Method IV.—By establishing points and "Key Lines" when no edge in the object is in a vertical position.

1. Establish the foremost point in the object. This is the one nearest the Picture Plane.
2. Draw a horizontal construction line through this point.
3. Find the angles made by the receding edges with this horizontal construction line and draw the slanting receding edges from this point. These receding lines are the "key lines."
4. Proceed as in *Method II.* or *III.*

PRINCIPLES GOVERNING THE APPEARANCE OF RECEDING HORIZONTAL SURFACES, ONE SURFACE PARALLEL WITH THE PICTURE PLANE

One Vanishing Point

When one vanishing point is used, that point is at the intersection of the Eye-Level with the Central-Direction-of-Seeing, called the Center-of-Vision, and must come within the limits of the object or group of objects. In an object with one vertical face parallel to the Picture Plane that face is drawn its true shape, with its edges horizontal and vertical. In such a position only-one other surface of the object can be seen; either the top of the object, when below the Eye-Level, or the bottom, when above the Eye-Level. In other words, where more than two surfaces of an object are visible, more than one vanishing point is necessary, and *no* *edge of the object appears or is drawn as a horizontal line.* This is not true when drawing single objects within other objects, as furniture in a room, objects in a street scene, etc.; because in the case of "interiors" or "street scenes," the whole room or street is considered as an object and the Central-Direction-of-Seeing Plane is always within the picture, at or near its center. The separate objects within these pictures are at right or left of the Central-Direction-of-Seeing Plane and show more than two surfaces and yet only one vanishing point is used. The drawing of these objects conforms to laws governing so-called "parallel" or "angular perspective" and will be explained under "interiors," which deal with the drawing of "picture compositions" rather than with objects or groups of objects.

Therefore, in drawing single objects placed directly in front of the eye, with one surface parallel to the Picture Plane, remember that only one other surface can be seen, and that the receding edges of this horizontal surface vanish on the Eye-Level at the Center-of-View. Investigate use of one vanishing point only. See Norton's *Freehand Perspective and Sketching*, Chap. XLI—1.

EXERCISES

Straight Line Objects, One Vanishing Point

Methods Note Book

Leave all construction lines and invisible edges in black lead pencil.

1. Draw a number of squares and oblongs in light pencil outlines.
2. Draw in sepia pencil outline, a book in a horizontal position with front face parallel to the Picture Plane.
3. Same as No. 2, with a cylindrical object in front of the book. Express the character of the book in dark and light lines.
4. A chair with seat below the Eye-Level in side view.
5. Same as No. 4 in front view.
6. A table below Eye-Level with a chair pushed under it at the end.

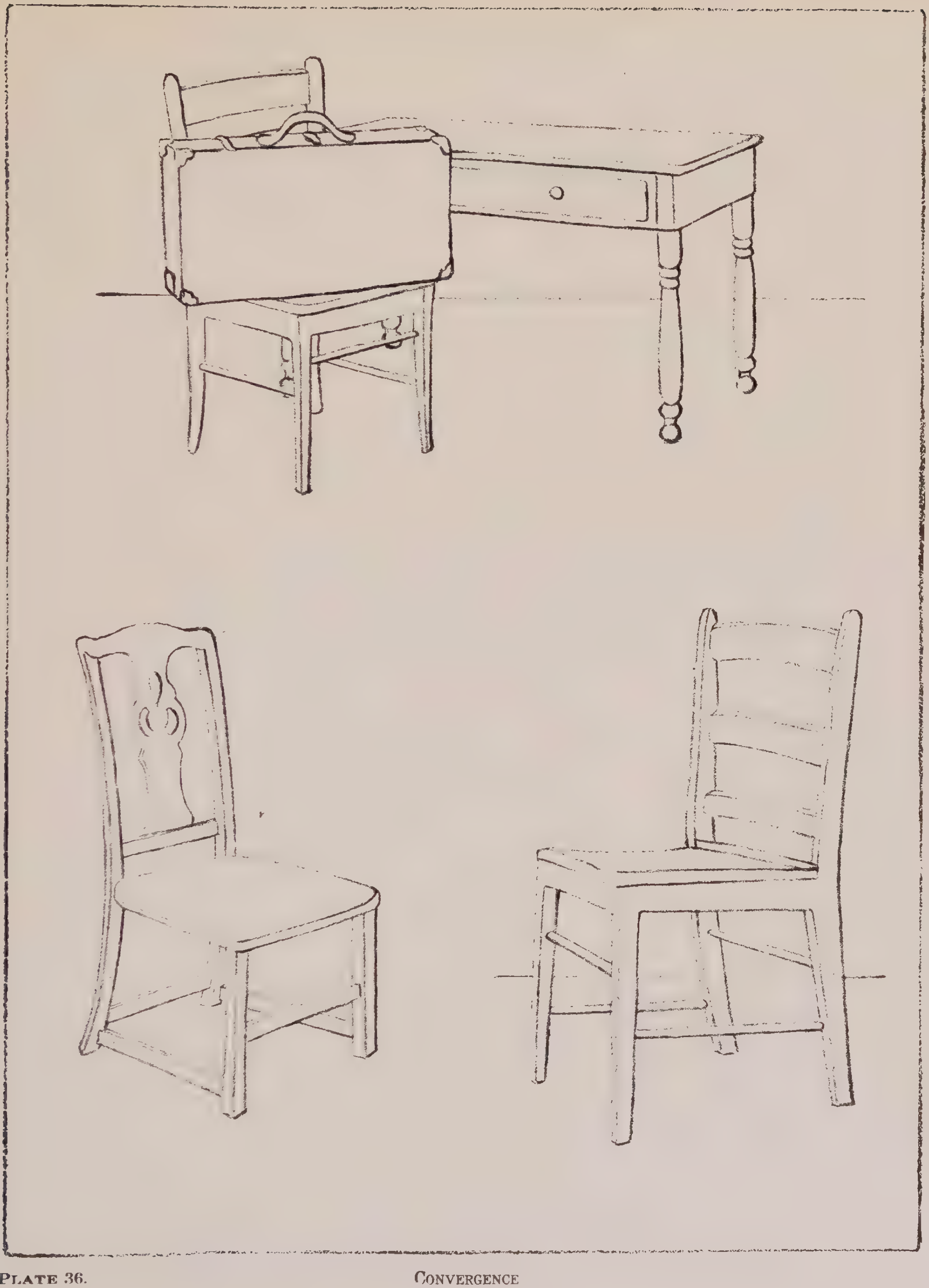


PLATE 36. CONVERGENCE

PRINCIPLES GOVERNING THE USE OF DIAGONALS FOR FINDING THE PERSPECTIVE CENTER AND MEASURING PERSPECTIVE DISTANCES INTO A PICTURE

Finding Perspective Center

It was found that the perspective center of an ellipse was not its real center. The perspective center of a rectangular or square surface is not its real center. The center, in perspective, is found by drawing the diagonals in the perspective drawing, which locate the perspective center at the point of intersection.

Placing Distances into a Picture

Diagonals are used to place distances into a picture. All measurements are made on lines, which are parallel to the Picture Plane. Converging lines are drawn from the points located on these lines to the vanishing points. Where the diagonals intersect the converging lines, the required distances are shown.

EXERCISES

To Find Perspective Measures—Diagrams Illustrating This Principle

Diagram I.—When surface is in horizontal position:

1. Draw an oblong or square in a horizontal position with one edge parallel to the Picture Plane.

2. Place measures in the front line nearest the Picture Plane.

3. Draw lines from these points that will converge at the vanishing point of the edges of the receding sides.

4. Draw diagonals and mark points of intersection of diagonals with converging lines. These points of intersection give the perspective measures.

Diagram II.—When surface is in a vertical position:

1. Draw in perspective an oblong or square in an upright position.

2. Place measures on the front line nearest the Picture Plane.

3. Draw lines from these points that will converge at the vanishing point of the edges of the receding sides.

4. Draw diagonals, and mark points of intersection of diagonals with converging lines. These points of intersection give the perspective measures.

PRINCIPLES GOVERNING THE APPEARANCE OF HORIZONTAL RECEDING SURFACES, NO SURFACE PARALLEL TO THE PICTURE PLANE

Two Vanishing Points

When more than two surfaces of an object are seen, more than one vanishing point is necessary, and no edge appears as a horizontal line.

When a horizontal surface is turned so that its edges form oblique angles with the Picture Plane, two vanishing points are required. These are on the Eye-Level, right and left of the Central-Direction-of-Seeing. The vanishing point of the edge that recedes the least, is further away from the Central-Direction-of-Seeing than that of the edge that recedes the most, *i. e.*, the less the slant, the further away from the Center-of-Vision is its vanishing point, and the converse.

All horizontal edges that are parallel in the object appear to vanish at the same vanishing point, and must be drawn more slanting, as they move above or below the Eye-Level Plane. The edges that are farther into the picture, and therefore nearer the Eye-Level, slant the least, as the back edges of a book, etc.

EXERCISES

Straight Line Objects With Two Vanishing Points

Methods Note Book

Leave all construction lines and invisible edges in black lead pencil.

1. Draw in sepia pencil outline a group of books, one of which has a face parallel to the Picture Plane, while the others are turned at angles to it. (Use the height of the front face of the first book as a measuring unit.) Draw the thickness of the covers.

2. Draw a group of books, with one book open in a horizontal position and an ink bottle placed in front of the group. (Use the height of the ink bottle for a measuring unit, and notice that the corners of the leaves describe an arc in opening.)

3. Draw a cereal box in an upright position, no face parallel with the Picture Plane, with a cereal dish and a pitcher in front or at the side of the box. (Use the front vertical edge of the box as a measuring unit.)

4. Draw a chair below the Eye-Level, no face parallel to the Picture Plane. Use the front vertical edge of the chair as a "measuring unit."

Portfolio Drawings

1. Draw in sepia pencil outline a chair with artistic lines and proportions, no face parallel to the Picture Plane.

2. Draw in sepia pencil a table in harmony with the lines of the chair, showing the top, and with no face parallel to the Picture Plane.

3. Design an advertising poster, which involves lettering and objects in perspective. Finish in outline and flat tones with colored crayons.

PRINCIPLES GOVERNING THE APPEARANCE OF CYLINDRICAL AND CONICAL OBJECTS, WHEN NOT IN AN UPRIGHT POSITION

When cylindrical objects are lying down in horizontal positions and turned away from the Picture Plane, the long edges and the *long axes of the cylinders* converge to the Eye-Level. The long axes of the ellipses which represent the round ends in perspective, are *always at right angles to the long axes* of the cylinders, in whatever position the cylinders may be. Therefore, in drawing a cylindrical or conical object, in position other than upright, draw the long axis of both the cylinder and the ellipse, and observe the principle of convergence of receding horizontal edges, and the perpendicular relation of the axes.

EXERCISES

Cylindrical and Conical Objects in a Horizontal Position

Methods Note Book

Leave in all construction lines and invisible edges in black pencil.

1. Draw in sepia pencil outline a cylinder turned away from the Picture Plane, with the long axis coinciding with the Eye-Level.

2. Draw a group of cylindrical or conical shaped objects, such as flower pots, stew pans, pottery, etc., one in an upright position, the others in horizontal positions, turned away from the Picture Plane and below the Eye-Level. (Use the height of the upright object as a measuring unit.)

PRINCIPLES GOVERNING THE APPEARANCE OF RECEDING EDGES WHICH ARE NOT IN A HORIZONTAL POSITION

More Than Two Vanishing Points

When edges of objects are not in a horizontal position, but slant up or down, they do not appear to converge at the Eye-Level.

1. When the slanting sides of any object with a square or rectangular base slope equally and would form a pyramid if extended, the correct appearance of these edges is drawn by finding the perspective center of the base, erecting a perpendicular axis from the center thus found, and extending the edges to a point in the perpendicular axis.

2. When a series of slanting edges are parallel in the object, they appear to converge at a point above or below the Eye-Level in what is called a "vertical trace." This "trace" is a vertical plane, parallel to the Central-Direction-of-Seeing Plane, and therefore perpendicular to the Eye-Level Plane.

EXERCISES

Straight Line Objects Not in a Horizontal Position

Methods Note Book

1. Draw a group of berry boxes, or similar objects, one of which is tipped up so that it is not in a horizontal position.

DIRECTIONS FOR DRAWING A HOUSE WITH POINTED GABLE ENDS

More Than Two Vanishing Points

Leave all constructions and invisible edges in black pencil. Reline visible edges in sepia pencil. (See Plate 37.)

Main House

1. Draw the measuring unit. (This is the front vertical edge of the house nearest the Picture Plane.)

2. Fix the Eye-Level upon it, or in relation to it. (It is usually better to have the Eye-Level within the picture than outside of it, better to draw the house with the Eye-Level low, with the person looking at it standing on the ground rather than above the roof looking down upon it.)

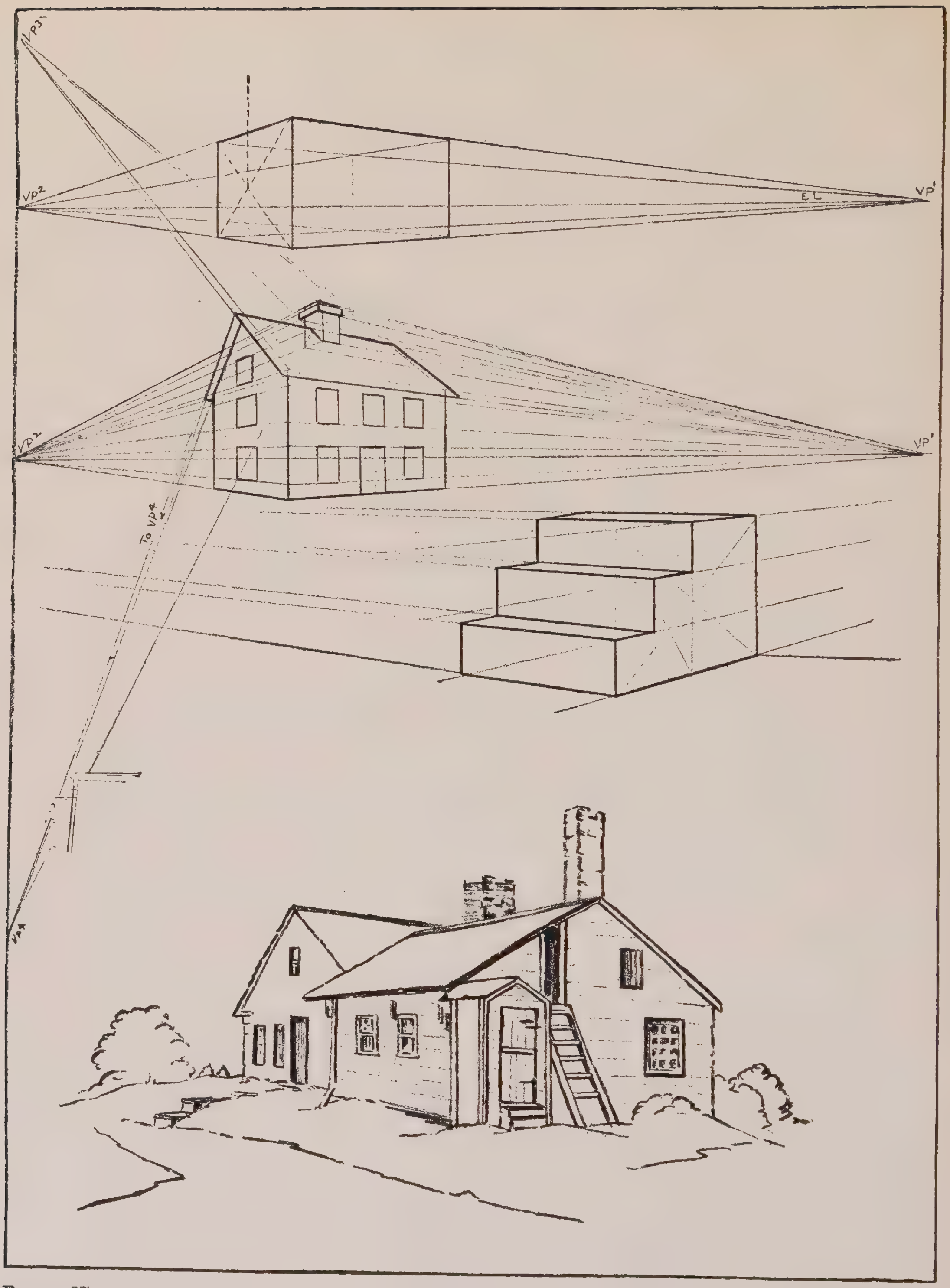


PLATE 37.

CONVERGENCE

3. Draw the key-lines in relation to the Eye-Level.

4. Draw the visible receding edges and find their vanishing points.

5. Establish the proportions of the vertical faces of the house, the ends and sides, and draw the invisible receding edges.

6. Find the perspective center of the ends of the house, by drawing diagonals.

7. Erect perpendicular axis of indefinite length through this center.

8. Estimate the height of the peak and indicate it on the perpendicular axis.

9. Draw the front edge of the gable from the top of the unit of measure, to the top of gable indicated on the perpendicular axis of the house.

10. Find the vanishing point of this line. (This vanishing point will be above the Eye-Level in a "vertical trace," through the vanishing point of the horizontal receding edges in the Eye-Level Plane, and parallel to the Central-Direction-of-Seeing Plane. Draw the line representing this trace, of indefinite length, extending it above and below the Eye-Level Plane.

11. Draw other end of the roof, by drawing a line from further end of the house to this vanishing point in the Vertical Trace above the Eye-Level Plane.

12. Draw the top of the roof (the ridgepole), which is parallel to the sides of the house.

13. Draw the other or further end of the gable from end of ridgepole through further vertical edge of house and find its vanishing point below the Eye-Level. (The farther lower horizontal edge of the roof is shorter than the nearer edge, therefore the farther gable ends converge downward toward the vanishing point in the Vertical Trace, below the Eye-Level Plane.)

Eaves of House—Projections Beyond the Roof

The edges which project beyond the house are parallel to the roof edges, and therefore converge to the same vanishing points as all other parallel edges in the house. Draw these projections correctly and get their perspective measures, as follows:—

1. Extend the upper edge of the house (gutter) to right and left of the gable ends (slanting edges).

2. Set off the width of the eaves, remembering that the nearer width is greater.

3. From these points draw lines to the vanishing point of the gables in the Vertical Trace above the Eye-Level Plane.

4. Extend the top edge of the roof (ridgepole) to intersect these slanting lines.

5. Draw from these points of intersection to the vanishing point in the Vertical Trace below the Eye-Level Plane.

6. Extend the front edge of the eaves of the gable line downward and forward.

7. Set off on this line the width of the eaves which come forward overhanging the sides of the house. (This will be less than the width right and left because it comes forward toward the Picture Plane, and is therefore more foreshortened.)

8. Draw lines from this point to the vanishing points in the Eye-Level. These lines cut off the length of the other gable eaves.

9. Draw the eaves of the further side of the house by drawing line from the last point found to the other vanishing point in the Eye-Level.

Windows and Doors in the House

1. Mark off on the "unit of measure" the height of the windows and doors.

2. Draw lines from these points to the vanishing points in the Eye-Level. (All parallel receding horizontal lines vanish toward the same point in the Eye-Level.)

3. Set off the perspective width of the windows and doors on these lines. (The widths become narrower as they go back from the Picture Plane. If the door is in the center of the side, find the perspective center by diagonals, and use the vertical for the perspective center of the door.)

Chimney in the Center of the House

1. Find the center of the side of the house by diagonals, and draw a vertical center line on the side wall.

2. From the end of this line draw a line on the roof to the vanishing point of the gable end in the Vertical Trace above the Eye-Level.

3. Establish, by estimating, the front vertical edge of the chimney, being guided in its position and height above and below the ridgepole, by the center line. (This is the unit of measure for the chimney.)

4. From the top and bottom of this unit of measure draw lines to the vanishing points in the Eye-Level.

5. From the lower end of the unit of measure draw a line to the vanishing point of the gable in the Vertical Trace above the Eye-Level.

6. From the intersection of the ridgepole and the line last drawn, draw a line to the vanishing point of the further side of the gable in the Vertical Trace below the Eye-Level. (Where this line crosses the vanishing line of the base of the chimney the width of the chimney from front to back will be established.)

7. Estimate the apparent vertical width of the front face of the chimney in relation to the center line, and complete the chimney. (The farther half is narrower than the nearer half.)

8. If a projecting band near the top of the chimney is drawn, establish its unit of measure and draw lines from its extremities to the vanishing point of the Eye-Level.

9. Complete by estimating the perspective measures of the widths beyond the main chimney. Draw verticals to complete the band.

Steps to the Front of the House

1. Draw a line from the nearer end of the door sill to the ground.

2. Divide this line into as many parts as steps to be drawn. (In this case, three.)

3. Draw lines through these four points to the vanishing point used for the gable end of the house, and extend these lines *forward* indefinitely.

4. On the lower or ground line of indefinite length just drawn, set off the width of the steps, and complete the vertical rectangle in perspective of the end of the steps.

5. Find the perspective center of this rectangle by drawing diagonals, and draw a vertical line through this center point. The farther half and upper third is the width and height of the broad top step.

6. Find the perspective center of the front half of the rectangle by drawing diagonals and draw a vertical line through the center point.

7. Outline the end face of the three steps thus found.

8. From the forward corners of the steps thus found, draw vanishing lines to the vanishing point of the side of the house.

9. From the farther corner of the doorsill draw a line to the vanishing point of the gable end of the house and extend it forward until it intersects the other vanishing line of the top step. This will complete the top step.

10. From the intersection of the two vanishing lines of the top step, drop a vertical line to the first vanishing line of the top of the second step.

11. Complete the top of the second step by drawing a line from the last point found to the vanishing point of the gable end of the house.

12. Complete the steps by repeating the processes described.

EXERCISES

House—More Than Two Vanishing Points

Methods Note Book

Leave all construction lines and invisible edges in black lead pencil.

1. Draw a house with gable end, overhanging eaves, chimney in center of roof, door in center of side, a window on each side of door, and one in gable end; three steps to the door.

2. Copy a drawing of a house from print or photograph. Draw Eye-Level on house and find vanishing points before copying. Mount original in *Methods Note Book* above or beside the copy made. (If vanishing points are off the paper, draw vanishing lines toward the imagined points.)

Portfolio Drawing

1. Make pencil drawing in three tones, from given picture of historic house.

2. Same of an Indian long-house.

3. Pencil drawing of a house with appropriate setting from imagination or Nature. (This may be done in dark and light tones in charcoal, crayon, in sepia pencil or water color, flat tones and outline drawing.)

4. Pencil drawing of flight of steps or staircase.

PICTURE COMPOSITION IN PERSPECTIVE

PARALLEL OR ANGULAR PERSPECTIVE

When drawing a picture composition in perspective in which many objects are brought together to make a unit, laws of design, or Fine Arts, as well as principles of perspective, must be considered.

1. A selection of some portion of any seen area must be made. For instance, a panorama is a difficult view to express in picture form, because it includes in a limited space almost unlimited distances. For a beginner in drawing only what can be seen within an angle of 60 degrees should be selected for a picture.

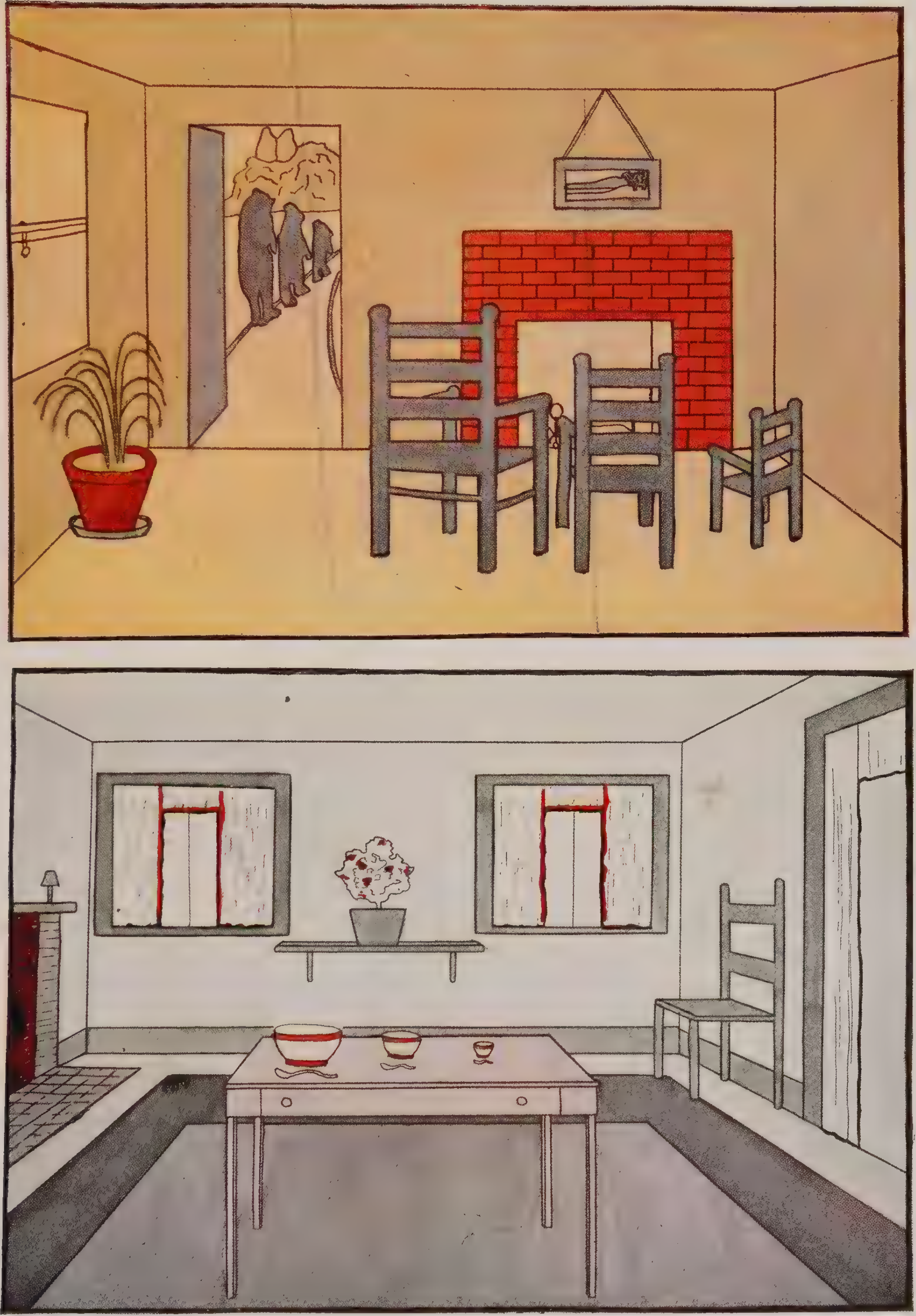


PLATE 38. STUDENTS' DRAWINGS — STORY ILLUSTRATION INVOLVING CONVERGENCE

2. When the dominant area in a picture (like the end wall of a room) is parallel to the Picture Plane the subordinate areas are drawn parallel to the Picture Plane and show their real shapes, even when they are right and left of the Center-of-Vision, and not parallel to the eye. Otherwise the picture would include too many angles at variance with each other and the eye would not be satisfied. This explains the reason for using only one vanishing point at the Center-of-Vision when drawing furniture within the room, when the furniture is placed parallel to the sides of the room. (See Norton, *Freehand Perspective and Sketching*, Chap. XXXIV.) When the furniture is placed in this position more than two sides may be seen, because placed at the right or the left of the Center-of-Vision, but, as has been stated, only one vanishing point is used.

The same principles of beauty hold true in drawing street scenes, when the Center-of-Vision is the vanishing point for the receding sides of the buildings. In such cases, the surfaces at right angles to them are drawn as parallel to the Picture Plane and show their real shape, even if they are not quite parallel in reality.

DIRECTIONS FOR DRAWING INTERIORS

Rear Wall Parallel to the Picture Plane

1. Establish the proportions of the back wall of the room which is parallel to the Picture Plane.

2. Find the Eye-Level on this wall and the Center-of-Vision. The Eye-Level is the height of a person standing, in relation to the height of the room,—usually a little less than two-thirds up from the floor line.

3. Draw the vanishing lines of the floor and the ceiling.

4. Establish the proportion of the side walls, floor, and ceiling to make pleasing proportions. Remember that this is a problem in design as well as perspective.

5. Design the back wall space by drawing doors, windows, a fireplace or bookcase, etc., according to the purposes of the room you are designing, as follows:—

Locate, by points, the height of the window, door, etc., on the front vertical line of the side wall nearest the Picture Plane which is the "unit of measure" of the room. Consider the proper height in relation to the Eye-Level. From the points thus located, draw vanishing lines on the side wall to the vanishing point (Center-of-Vision).

Draw horizontal lines on the back wall from the point of intersection of the vanishing lines and the back vertical line of the side wall (which is also the vertical line of the back wall). These horizontal lines establish the height of the window, door, etc. Draw the width between these lines on the back wall, after considering the proportion and position left or right on the wall according to principles of good design.

6. Design the side walls in the same way.

7. Place objects, tables, chairs, etc., in the room parallel to the walls.

Locate the length of the object, say a table, on the front horizontal line of the floor nearest the Picture Plane. From points thus located draw vanishing lines on the floor to the vanishing point (Center-of-Vision).

Locate, by a point, the height of the object on the front vertical line of the side wall nearest the Picture Plane. From this point thus located draw vanishing line on the side wall to the vanishing point (Center-of-Vision).

First locate the position of the object on the side wall by drawing a vertical line from the side floor line up to the vanishing line of the height already established.

Draw horizontal lines from the extremities of this line, one on the floor, the other above. These horizontal lines establish the height of the object out into the room. Where the horizontal line on the floor intersects the vanishing lines of the length already drawn, will be the front edge of the object (table) on the floor.

The front face of the object is then drawn its true shape in the position, which has been established between the horizontal line on the floor and the other horizontal line above, which limits its height in correct proportion to the size of the room.

The proportions of receding surfaces of the object are estimated and drawn to "look right," and satisfy the eye, their edges vanishing at the vanishing point (Center-of-Vision). When the position, proportions, and shape of one object in the room has been drawn in perspective, other objects may be drawn in relation to it without measuring the length and height on the front horizontal and vertical lines of the room.

8. Place objects in the room not parallel to the walls.

When objects are placed not parallel to the walls, more than one vanishing point is necessary, *i. e.*, each object is drawn as if it were alone and the vanishing points of its receding horizontal surfaces found on the Eye-Level. The position of the object is found on the floor and its proportions are found by establishing its "unit of measure" and then estimating the proportions of its receding surfaces in relation to this measure.

EXERCISES

Room Interiors

Methods Note Book

1. Draw a room using one vanishing point; place the door and one window on the back wall; a door and a picture on the side wall; a chair against the side wall under the picture; and a table against the opposite wall.

Portfolio Drawing

1. Design the interior of any room and furnish with three or more pieces of furniture; add rug, draperies, pictures, etc. Color in some simple color scheme. (See Color Harmonies.)

2. Design an interior as a setting for some story. Use only one vanishing point.

Subjects Suggested

The Three Bears.
Priscilla and John Alden.
Banquet Scene from Ivanhoe.
Snow-Bound.

MECHANICAL DRAWING

Working Drawing

Mechanical Drawing, sometimes called "industrial" and "constructive drawing," which is here treated in an elementary manner as an introduction to the subject known as "Mechanical Drawing," is geometric drawing done with tools made especially for the purpose. It includes "working drawing," which is a form of expression universally used. These drawings convey a definite idea of mechanical and architectural constructions and are used in elementary school work to give the necessary measurements, etc., for articles made in paper, cardboard, wood, metals; for plans and diagrams, for drafted patterns for clothing, etc. It is therefore a "universal language," a "written language of lines instead of letters," and like all languages has definite conventions which must be employed in its use.

Preliminary sketches, called "free-hand working drawings," are often made. Their purpose is to convey an idea, record certain facts, and give data to be developed later in an accurate (instrumental) drawing to measure. They are very useful and should be more generally understood, since often a simple object may be made from a sketch of this kind without the aid of a more technically developed mechanical drawing. The ability to read working drawings, maps and diagrams, as well as to make them, is very important. It is therefore necessary in the study of this subject to thoroughly learn—

1. The proper use of tools.
2. The conventions used in making the drawings.
3. The principles upon which the drawings are based.
4. The geometric constructions from which they are developed.

TOOLS

1. The T-square.

The T-square is used in connection with the drawing board. It has a head (small cross piece at end) and a blade. The head should always be placed against the left edge of the board, so that the left hand can be used to move it up and down. (For left-handed persons it should be placed against the right edge.) It is used for ruling *horizontal* lines only (on the top edge, never on the bottom edge of the blade), and as a rest upon which the triangles are placed. It may be taken from the board, turned over, head up, and used to rule long lines in other positions, but it is not used then as a T-square but as a straight edge.

2. TRIANGLES.

There are two triangles used in connection with the blade of the T-square upon which they rest: one to rule lines at angles of 90° and 45° with the horizontal; the other, to rule lines at angles of 90° and 30° and 60°. The combination of the two triangles together with the T-square may be used to rule lines at angles of 15° and 75°. The triangles are also used to draw parallel lines by slipping one angle on the other; and, instead of a straight edge, and independently of the T-square, to rule any slanting line.

3. THE SCALE.

Sometimes called "ruler," used only for measuring and marking distances and never for ruling lines.

4. THE COMPASS.

Used for drawing circles and arcs. In the sloyd "excelsior" compass, which is attached to the pencil, the points of the compass and the pencil should be even, except when a large radius is needed, then the pencil is slipped through the compass.

5. THUMB TACKS.

It is always necessary to have the drawing paper pinned onto the drawing board before beginning a mechanical drawing; one tack is sufficient in each of the upper corners of the paper, which should be placed high on the board. Never draw on a loose paper which can be moved about, since then the tools are of no use.

6. PENCILS.

Use a hard pencil with a sharp point.

(For more advanced forms of mechanical drawing other instruments are used, as compasses with attachments, ruling pen, etc.)

1. LINES USED IN MECHANICAL DRAWING.

(1) Long and short dash lines for center-lines.

A light thin line made of long and short dashes used as a line from which the principal dimensions are laid off, and upon which centers are located. These lines are not necessarily in the center of the paper or drawing. They should be the first lines drawn in making any working-drawing.

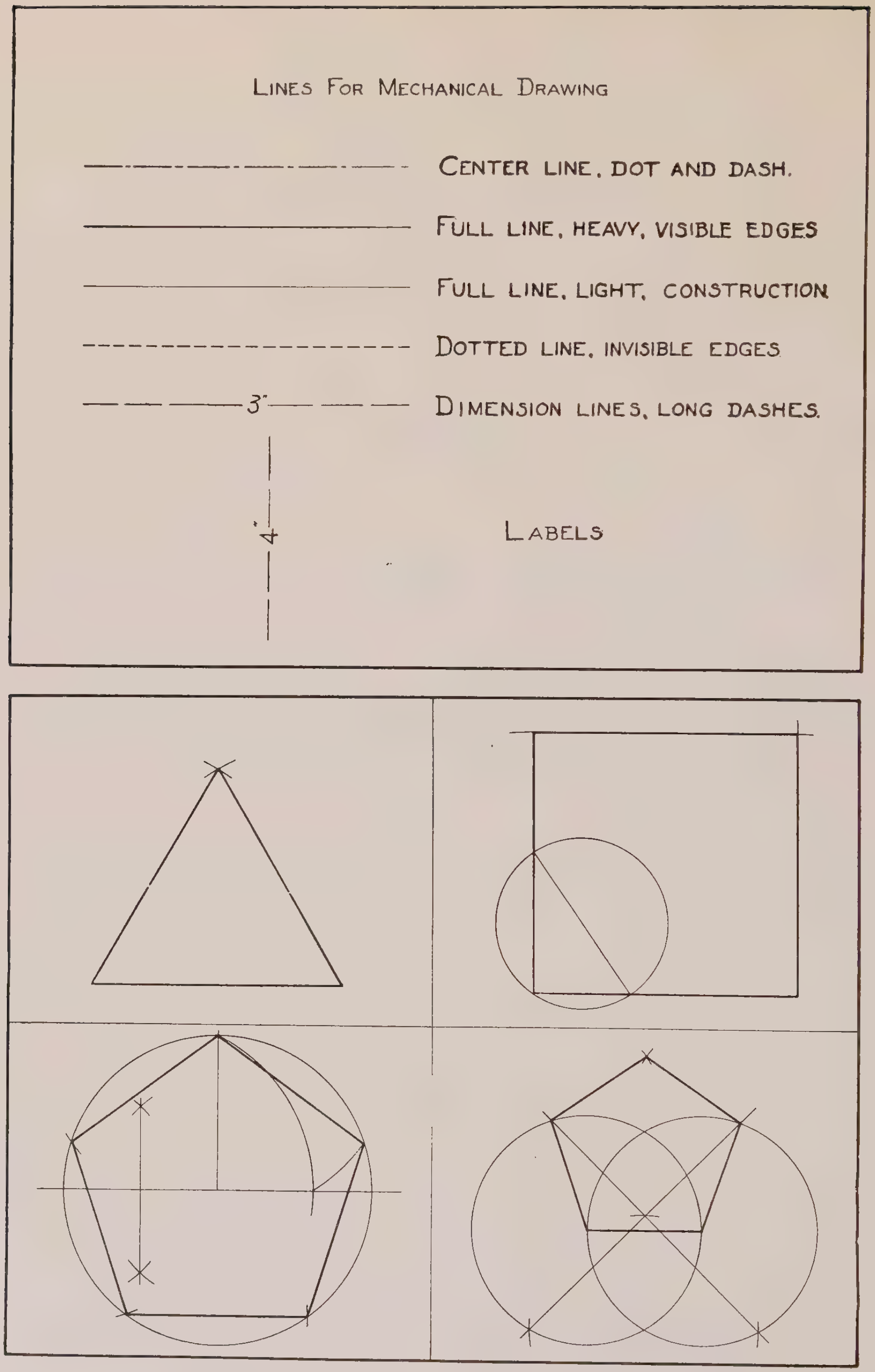

LINES FOR MECHANICAL DRAWING
CENTER LINE, DOT AND DASH.
FULL LINE, HEAVY, VISIBLE EDGES
FULL LINE, LIGHT, CONSTRUCTION
DOTTED LINE, INVISIBLE EDGES
DIMENSION LINES, LONG DASHES.
3"
4"
LABELS

PLATE 39. CONVENTIONS AND GEOMETRICAL CONSTRUCTIONS

(2) Full line for seen edges.

A medium weight, continuous line used for all result lines in geometric figures, margin lines, and for visible edges of objects. The margin lines are sometimes heavier.

(3) Short dash for invisible edges.

Same weight as the full line, made of 1/8 of an inch dashes, used for all "hidden" or invisible edges of objects.

(4) Light full or short dash lines for projection lines.

A very light, thin line of short dashes, or a light continuous line used (*a*) to project measures from one view to another (these are omitted in "shop drawings" and the measures are projected by using the T-square and triangles); and (*b*) to project measures from the termination of lines to the dimension lines when these lines are outside the views.

(5) Long dash lines with arrow heads for dimensions.

A very light, thin, long dash line with arrow heads at the extremities used in connection with figures to give measurements of the length of edges and size of objects.

2. DIMENSIONING.

Good dimensioning of a working drawing is most important.

(1) The figures should be drawn with care, full, round, and large enough to be legible. They should be drawn, not written.

(2) They should be placed between the dashes of the dimension lines, half above and half below the line.

(3) They should read:—

- (*a*) for horizontal measurements, from left to right.
- (*b*) for vertical measurements, from bottom to top.
- (*c*) for angular measurements, an arc described with the vertex of the angle as a center.
- (*d*) for the radius of an arc, on a line from the arc to the center used in drawing the arc.
- (*e*) for circles, if within the circle on line at an angle to center lines, figures read from the circumference toward the center; if without the circle, on line parallel to the center lines and projected from the center lines the full length of the diameter.

(4) “The lines should not be closer than one-fourth of an inch to any line of the object or other dimension lines and should not cross each other when it can be avoided.”*

(5) In printing a fraction the line between the numerator and denominator called the vinculum should always be parallel to the dimension lines and never oblique to them.

(6) The arrow-heads should be at the extremities of the dimension line, which is the full length of the edge of the object measured. They should never be next to the figures. They should be carefully drawn and narrow, running back on the dimension line a little way before flaring out from it.

(7) The signs for feet and inches should be used, not the abbreviations. If a dimension is given in feet and inches, it should read thus: “2′ 6½″”; if in even feet, “16′ 0″”; if in feet and a fraction of an inch, “15′ 0¾″.”

(8) “All over” dimensions give the greatest dimension of an object in any direction, and should always appear in a “working-drawing.” Detail and smaller dimensions should balance the “all over” dimensions.

3. Margins.

All mechanical drawings should have a margin carefully drawn and measured. When drawn according to the following rules any unevenness in the cutting of the paper is avoided, and the “trimming-line” prevents thumb-tack holes from appearing in the corners of the finished drawing. When the paper is small, school size, the trimming-line may be omitted and the paper held in place by slipping it up under the heads of the thumb-tacks instead of having the tacks pinned through it.

Draw a margin according to the following method used in technical schools:—

1. Find center of paper by placing T-square blade across corners of paper and drawing part of the diagonals near the center to find their intersection.

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* Quotations from ‘‘Applied Mechanical Drawing,’’ by Mathewson and Stuart. Pub. Taylor-Holden Company.

2. Pin paper on board with top edge of paper even with top edge of T-square. When paper has to be removed from the board and replaced, always replace by T-square as above.
3. Draw diameters across the paper with light fine lines.
4. Measure right and left on horizontal diameter the number of inches required for half length of plate within the margin line.

   Beyond these points place others, the width of margin.
5. Measure up and down on vertical diameter the required number of inches for width of plate, within the margin line. Beyond these points place points, the width of the margin.
6. With T-square draw horizontal lines through points at top and bottom of paper.
7. With 60° and 30° triangle placed on T-square draw vertical lines through points at right and left of paper.
8. Erase where lines have crossed, and also the construction diameters unless they are to be used in the drawing.
9. Reline margin in clear, full line with clean corners.
10. Label with number of plate in upper right-hand space ⅛ of an inch above margin line, and place name in lower right-hand space ⅛ of an inch below margin line. Use plain Gothic single line letters, 3/16 of an inch for capitals, ⅛ of an inch for small letters, 3/16 of an inch for figures. Use Arabic numerals. Have the labels end nearly on a line with the vertical margin line.

GEOMETRIC CONSTRUCTIONS—FIGURES

Geometrical figures and solids are the basis of many kinds of construction work and all mechanical drawing. Their construction should be thoroughly understood. The geometric figure has two dimensions,—length and breadth,—therefore a square is a figure, a cube is not.

A polygon is a geometric figure bounded by straight lines, named from the number of its sides, as follows:—

Number of Sides.	*Names.*	*Number of Sides.*	*Names.*
Three.	Triangle.	Seven.	Heptagon.
Four.	Rectangle (square or oblong).	Eight.	Octagon.
		Nine.	Nonagon.
Five.	Pentagon.	Ten.	Decagon.
Six.	Hexagon.	Twelve.	Dodecagon.

EXERCISES

Geometric Construction—Figures.—For all the following problems divide the drawing sheet into four rectangles, and draw a problem in each rectangle. Make the drawings as large as the space will allow and place them well. Draw in light lines, and when the problem is finished reline the result lines only, leaving the construction lines light, but do not erase them. Do not number or letter the problems.

There are two methods of construction:—

1. The geometrical.
2. The draftsman's method.

The first is done by geometry, the second by use of drawing instruments.

Draw the problem by the first method unless otherwise indicated.

Plate 1

1. To bisect a straight line.

Draw any straight line. With the ends of the line as centers, and a radius greater than half the length of the line, describe arcs which intersect each other above and below the line. Connect points of intersection of arcs by a line which is perpendicular to the line at its center point.

2. To erect a perpendicular at the end of a line.

Draw any line. Place a point outside the line. With this point as a center, and a radius equal to the distance from the point to the end of the line, draw a circle. Draw the diameter of the circle at the intersection of the line and the circumference of the circle; the other end of this diameter will be above the end of the line. Connect this point by a line, which is the perpendicular required.

3. To bisect an angle.

Draw any angle. With the vertex of the angle as a center and any radius, draw an arc intersecting the sides of the angle. With these points of intersection as centers, and same radius, draw arcs, which intersect. The line that connects the vertex of the angle with the point of intersection bisects the angle.

4. To divide a given line into any number of equal parts.

Method 1.—Draw a straight line. From one end of the given line draw another line at an acute angle to it. Beginning at the vertex of the angle measure on the second line drawn as many parts as are required.

Connect the last point with the end of the given line and draw parallels to this line through the remaining points located on the line. Draw the parallels by sliding one triangle on the other.

Method 2.—Draw a line; draw a line at any angle from one end of the given line. Draw another line at the same angle from the other end of the given line on the opposite side. Beginning at the vertex of the angle, measure off on second line drawn the number of parts required. Repeat on the opposite line. Connect first and last points measured. Draw parallels to this line by connecting opposite points.

To construct Regular Polygons.—After drawing the plate required, construct the polygons of tag-board and cut out accurately and label each one. Make envelope for holding the collection.

PLATE 2

To draw regular polygons of three, four, and five sides.

1. To construct an equilateral triangle on a given base.

Draw the base. With the ends of the base as centers, and a radius equal to its length, draw arcs which intersect. Connect the point of intersection with the ends of base. Test by using the 60° triangle on the T-square and label size of angle (draftsman's method).

2. To construct a square on a given side.

Draw base of square. Erect perpendicular from end of base. With a radius equal to the length of base, draw arc, cutting perpendicular. With end of perpendicular and end of base as centers and same radius, draw arcs which intersect, giving the fourth corner. Complete square.

3. (*a*) To construct a pentagon within a circle.

Draw the circle. Draw horizontal and half of vertical diameters. Bisect one-half of the horizontal diameter. With this bisection point as a center, and a radius equal to the distance from the point to the end of vertical diameter, draw an arc cutting the other half of the horizontal diameter. With end of vertical diameter as a center and a radius equal to the distance from this center to the point of intersection of the horizontal diameter with arc, draw an arc intersecting the circumference of the circle. The distance from the end of the vertical diameter to this last intersection on the circumference of the circle is one side of the pentagon. Complete the pentagon by laying off this distance around the circumference.

(*b*) Draw a star and cut it out of tag-stock by first constructing a pentagon as above.

4. (*a*) To construct a pentagon on a given base.

Draw the base. With the ends of the base as centers and the length of the base as radius, draw circles which intersect at points above and below the base. Connect these points with a line. With the point of intersection below the base as a center, and the same radius, draw an arc which gives three points of intersection,—two through the circles drawn, and one through the line last drawn. Draw a line through one intersection of arc with the circle, and through the intersection of line and arc, and extend until it cuts the other circle. Repeat on the other side. Connect points thus formed with base line of pentagon. There are now three sides of the pentagon. Find the fifth point and complete the pentagon.

(*b*) Fold a pentagon by tying a knot in a strip of paper ½ of an inch wide and 6 inches long. Flatten out into a pentagon.

PLATE 3

To construct a regular hexagon.

1. Hexagon within a circle.

Draw circle. Draw one of its diameters. With ends of diameters as centers and the same radius, draw arcs intersecting circumference of circle. Complete hexagon by connecting the six points by straight lines.

2. Hexagon on a base by the draftsman's method.

Draw base with T-square. With the 60° triangle on the T-square draw four lines of indefinite length from ends of base, slanting toward the right and toward the left. Draw diameter through center at point of intersection made by 60° lines previously drawn, and extend it to cut the 60° lines slanting out from ends of base. Complete the hexagon by drawing lines, with the 60° triangle resting on the T-square, from last points found at ends of diameters and by a line drawn with the T-square. Leave construction lines of indefinite length, but reline the sides of the hexagon.

3. Hexagon on a long diameter, same method as 2.

Draw long diameter. Find its center. Complete hexagon by using the 60° triangle on the T-square as in problem 2. Start with ends of diameter instead of base. Draw lines through the center point.

4. Hexagon on a short diameter. Same method.

Draw a short diameter with the T-square. Draw perpendiculars of indefinite length at ends of diameter; find center of diameter. With 30° triangle on T-square draw lines through center of the diameter; these will cut to the right length the perpendiculars which form the two sides of the hexagon. Complete the hexagon with the 30° triangle on the T-square.

PLATE 4

1. Construct a polygon of any number of sides on a base, in this case a heptagon.

Draw a base. With the end of the base as a center and a radius equal to the length of the base, draw an arc. Extend the base so that it cuts the arc. Divide the semicircular arc into as many parts as are required for the polygon, in this case seven. Begin with first dot measured and number 1, 2, 3, etc. Draw a line from end of base, which forms the center of the semicircle through point 2. Bisect the base, and the line from the base to point 2. With the point of intersection of bisectors as a center, and a radius equal to the distance from the point to the end of base, draw a circle. Lay off on the circumference of the circle the length of the base and thus complete the heptagon.

2. Construct a polygon of any number of sides within a circle, in this case seven.

Draw a circle. Draw its vertical diameter. Divide diameter into as many parts as are required for the polygon, in this case seven. Number them 1, 2. 3, etc. With the ends of the diameter as centers, and a radius equal to the length of the diameter, draw arcs which intersect. Draw line from point of intersection through point 2, measured on the diameter, and extend so that it cuts the circumference of the circle. Draw line from nearer end of diameter to this point and thus obtain one side of polygon. Lay off on circumference the other sides and complete the polygon.

3. Construct an octagon upon a given side.

Draw base: (1) erect perpendiculars of indefinite length from ends of base.

(2) With ends of base as centers, and radius equal to length of base, draw arcs.

(3) Extend base in both directions to intersect arcs.

(4) Bisect right angles made by the perpendiculars and the extensions of the base, and extend the bisectors to intersect the arcs.

(5) Connect points of intersection of arcs and bisectors by a line parallel to the base.

(6) With point of intersection of this line and the perpendiculars as centers, and the length of the base as radius, draw arcs intersecting the perpendiculars.

(7) Draw line of indefinite length through these points parallel to the base.

(8) With these points of intersection as centers, and radius equal to the perpendicular distance from the base to the first horizontal line parallel to the base, mark off the other four points on the lines drawn and so complete the octagon.

4. Construct an octagon within a square.

Draw square; draw diagonals of square and find center; with the corners of the square as centers, and radius equal to half the length of the diagonal, draw arcs intersecting the sides; connect points of intersection and complete the octagon.

Plate 5

1. Construct trefoil on equilateral triangle.

Draw triangle; with corners of triangle as centers, and radius equal to half the side, draw circles.

2. Construct trefoil on equilateral triangle.

Draw triangle; with center of sides as centers, and radius equal to half the length of the sides, draw circles.

3. Construct quatrefoil on a square.

Draw square; with corners of square as centers, and radius equal to half the length of sides, draw circles.

4. Construct cinquefoil on a pentagon.

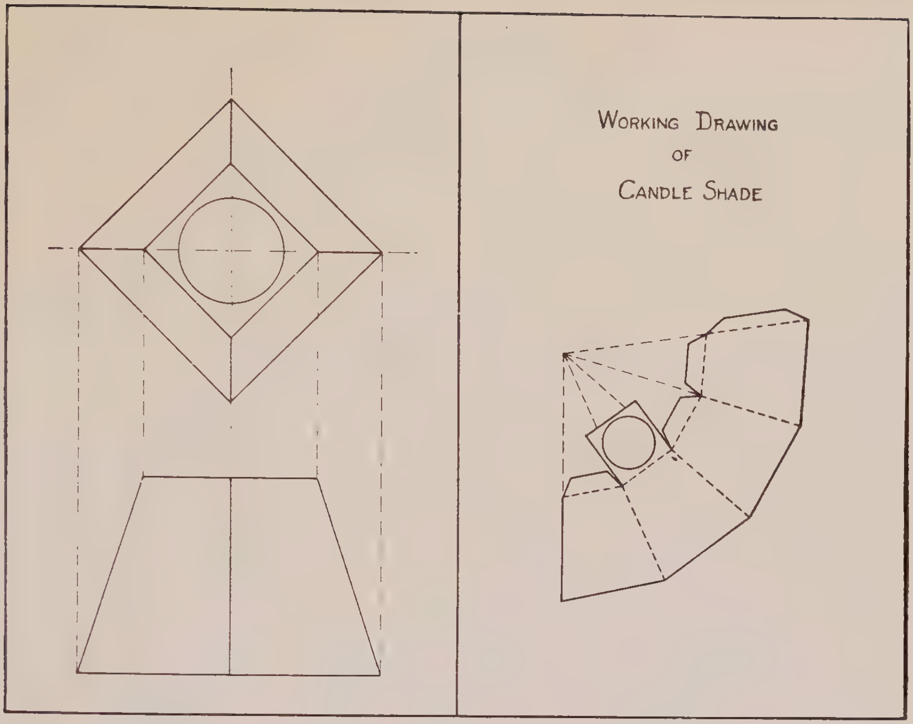
Draw pentagon; with corners of pentagon as centers, and radius equal to half the length of the side, draw circles.

PRINCIPLES OF THE WORKING DRAWING

Position of Views

In elementary forms of working drawings three "views" are usually given, although if all necessary information regarding the object to be made is shown in a less number of views, that number is used. These views are called *top*, *front*, and *side* views, or *plan*, *front elevation*, and *side elevations*. Since the working drawing is based upon exact geometric science called "orthographic projection" the position of these views is fixed, and the measures represented in the views are "projected" over from one view to another.

In imagination these views are drawn on planes at right angles to one another, and the views are projected to the planes by perpendiculars erected from all the different points of the object to the planes. The



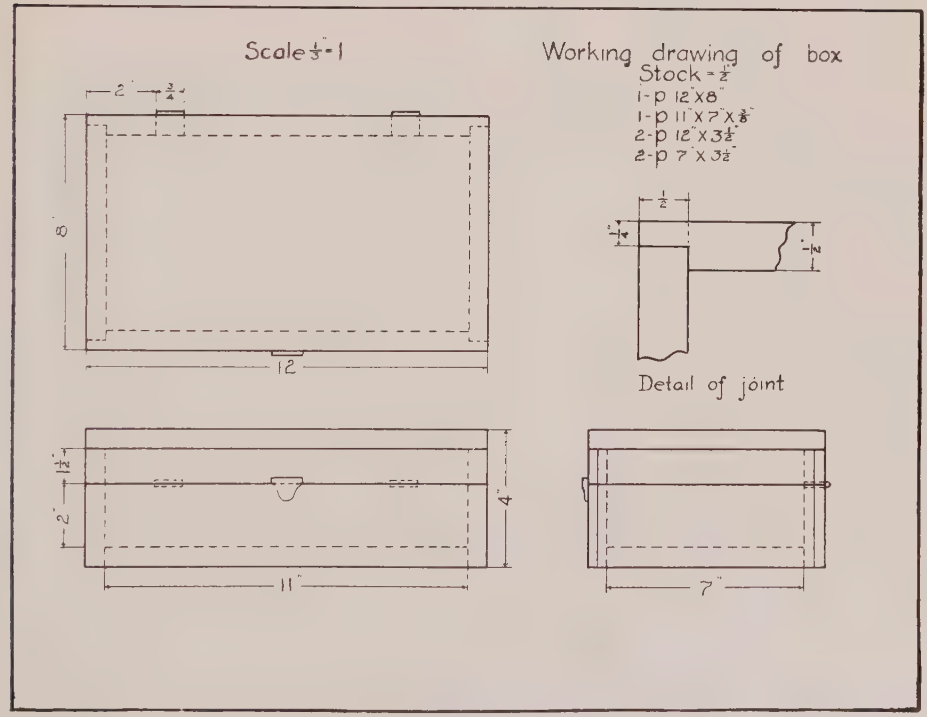


PLATE 40. THE WORKING DRAWING

top view is drawn upon the *horizontal plane*, the *front view* on the *front vertical plane*, and the *side views* on the *side vertical planes*. Therefore the three dimensions of the object are represented: the *top view* shows the width and length; the *front view* the length (which was also shown in the top view), and the height; the *side views* show the height (also shown in the front view) and the *depth through* the *object on its center-line from front to back*, which was also shown in the top view.

The paper upon which the drawings are made, called the *picture-plane*, has only two dimensions, and all the planes taken together (top, front, and side), upon which, in imagination, the surfaces of the object have been projected, are at right angles to each other. In order to represent these planes on the surface of the paper, they have to be flattened out, by turning up the horizontal plane and revolving out the side planes so that they will lie in same plane as the vertical plane, and can thus be represented on the picture-plane of the paper. This brings the top view above the front view and directly over it; the front and side views on the same level; the left side at the left (when used), and the right side at the right of the front view. These views are never placed in any other position.

The measures of one view are "projected," *i.e.*, carried over, to the other view by either lines, (or in "shop drawing" by instruments), except the depth of the side view, which has to be measured on the center-line and transferred to the other view by measuring it on that view.

PURPOSE OF THE WORKING DRAWING

The purpose of the views is to make clear the size, shape, details, etc., of an object so that the object can be constructed.

The *top view* represents the surface of the object that may be on top and whatever may be behind it, as seen through the horizontal plane.

The *front view* represents the surface of the object that may be in front and whatever is behind it, as seen through the front vertical plane.

The *side view* represents the surface of the object that may be in front and whatever is behind it, as seen through the side vertical plane.

DEVELOPMENTS OR PATTERNS

From working drawings are made flat patterns called *developments*. These are used in the construction of objects made in paper, cardboard, metal, cloth, and other flat materials, such as envelopes, boxes, garments.

articles made of tin, etc. They represent the object as a flat surface, which later is folded or molded into shape.

GEOMETRIC CONSTRUCTION—SOLIDS

Geometric solids have three dimensions,—length, breadth, and thickness. Those in common use are:—

Cube, prism, cylinder, pyramid, cone.

The ends are called "bases," no matter in what position the solid may be placed. The sides are called "lateral faces."

In prisms the faces are always rectangular parallelograms, and the prism is named from the polygon which forms its base as follows:—

Triangular prism, square prism, rectangular prism, pentagonal prism, hexagonal prism, etc.

In pyramids the faces are triangles and the pyramid is named from the polygon which forms its base.

Therefore it requires a drawing of at least two views to show any kind of solid.

EXERCISES

Views, developments, models, and objects of practical use.

For the following drawings divide the sheet into two rectangles by a vertical diameter. Place the views in the left rectangle, the development in the right. Leave light all construction lines, including the projection lines. Reline the result lines. Dimension carefully with full size required, but make the views and developments one-half size or less; *i.e.*, make drawings to scale; model full size according to dimensions on the drawing.

In making the models place the laps for pasting on the ends of the *faces*, not on the bases. In case of the cylinders make the bases double by pasting a base within the laps and also one on the outside.

PLATE 1

(*a*) Two views of a cube. Development of same.
(*b*) Model in paper of same.
(*c*) Model by folding, not to measure.

PLATE 2

(*a*) Two views of rectangular prism. Development of same.
(*b*) Model in paper.
(*c*) Model by folding, not measured.

PLATE 3

(*a*) Draw three views and section of a "coin box," with circular bottom and two compartments, size $1\frac{1}{4}$ inches deep, $2\frac{1}{2}$ inches wide, $5\frac{1}{2}$ inches long.

(*b*) Make up in straw board.

1. Develop in straw board with scored edges.
2. Glue corners with "super" or thin cloth or gummed paper.
3. Cover with cover paper, allowing $\frac{1}{4}$ of an inch for turned edges.
4. Glue in partition.
5. Cover ends inside the box.
6. Glue in papers for curved bottom in each compartment.

(*c*) Design and make up in heavy paper (Indian Kraft) a *pencil box* with a sliding cover. Allow thickness of paper additional to width and height for cover.

(*d*) Make folded paste pan.

(*e*) Folded water cup.

PLATE 4

(*a*) Three views of triangular prism. Development of same.

(*b*) Model in paper.

PLATE 5

(*a*) Three views of hexagonal prism $\frac{1}{2}$ an inch high. Development of same.

(*b*) Design a basket or box suitable for an Easter, May Day or Christmas token, or dinner favor, based on any of the geometric forms. Decorate the same with some simple, appropriate design in harmonious colors.

PLATE 6

Two views of a cylinder. Development of same. In order to measure the distance around the cylinder divide the circumference in the *top view* into twenty-four parts by using the triangles, and use the short cord found in this way as a unit of measure in finding length of face in the development.

PLATE 7

Two views of a cone. Development of same.

Plate 8

(*a*) Two views of a square pyramid with edges of base placed at 45° to the vertical plane.

Development of same.

(*b*) Design a candleshade and make up in paper. Diameter of top 2⅛ inches.

Other Exercises

1. Doll house and furniture.

2. Paper and cardboard constructions illustrating stories, historical subjects, domestic subjects.

3. Games and toys.

4. Useful objects,—portfolios, boxes, etc.

Shop Drawing

Objects to be made in wood.

List of projects:—

- Seed flat for planting seeds in the school room.
- Emergency box for sewing materials, bandages, etc., for teacher's desk.
- Book-rack for teacher's desk.
- Letter-rack for teacher's desk.

COLOR THEORY

COLOR TERMS

Every color has three qualities:—

1. Its color, called its *hue.*
2. Its degree of light or dark, called its *value.*
3. Its degree of *intensity;* that is, its bright or dull quality, sometimes called its *chroma.*
4. *Tone* is a general term used to describe one or more of these qualities.

For examples of these color qualities:—

In a bright, dark red—
Red is its hue.
Dark is its value.
Bright is its degree of intensity.

In a dull, light green—
Green is its hue.
Light is its value.
Dull is its degree of intensity.

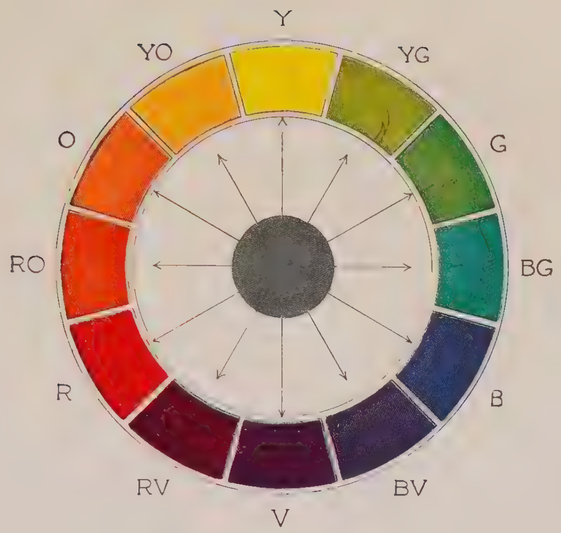
Therefore a dull color is a neutral color, and a bright color is an intense color. (See Color Intensities.)

COLOR CLASSIFICATIONS

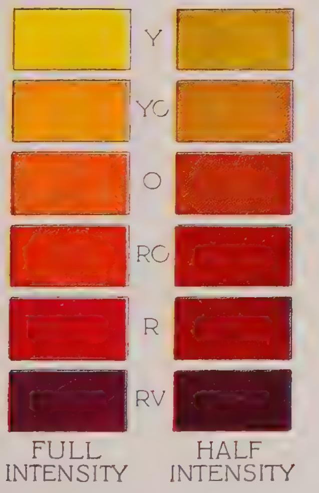
1. HUES

The three paints usually used in school water-color boxes are yellow (Y), red (R), and blue (B), called *primary* colors. From these are made orange (O), green (G), and violet (V), called *secondary* colors. These are sometimes called the *six standard pigments* or colors.

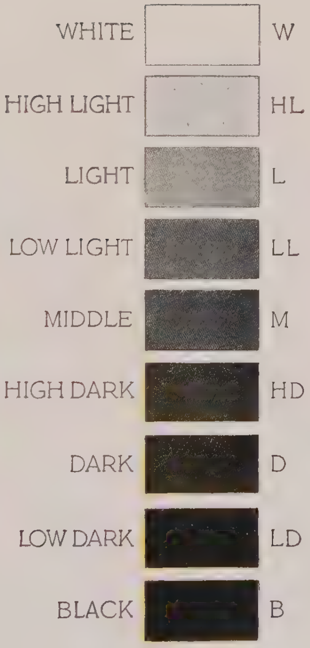
Each of these six colors has variations from the pure hue according to the amount of a closely related color it contains; for example, since orange and violet each contains some red, both are closely related to red; therefore a pure red may become a violet red *hue* or an orange red *hue*



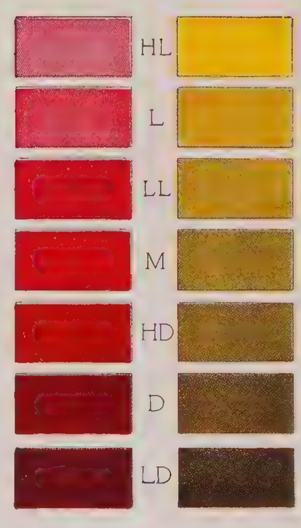
COLOR WHEEL



SCALES OF INTENSITY



SCALE OF NEUTRAL VALUES



SCALES OF COLOR VALUES

PLATE 41.

COLOR WHEEL AND VALUES
From *The Use of the Plant in Decorative Design*
SCOTT, FORESMAN & COMPANY

according to the amount of violet or orange that appears in it. This change from the pure hue may be more or less pronounced, but is named according to its *dominant color*, *qualified* by the name of the added hue. These *qualified hues* are called *intermediate hues*. Each color has two intermediate hues, making eighteen hues, as—

Pure Hue.	*Intermediate Hue.*	*Pure Hue.*	*Intermediate Hue.*
1. Yellow.	Orange yellow.	4. Violet.	Blue violet.
	Green yellow.		Red violet.
2. Green.	Yellow green.	5. Red.	Violet red.
	Blue green.		Orange red.
3. Blue.	Green blue.	6. Orange.	Red orange.
	Violet blue.		Yellow orange.

EXERCISES

Color Hues.—1. Make a graded hue scale according to the following:—

Make a series of five or more circles or any plane figure. Paint the center figure the pure hue. Paint the series on one side of the center by adding to each succeeding figure a larger quantity of one of the related colors until a pronounced "intermediate hue" is reached; use the other related color for the other side of the center. Maintain the *dominant color* throughout the scale, and keep all the colors *equally light and equally bright*, *i. e.*, same value, same intensity.

2. Collect specimens of hues found in nature, silks, or other materials. Mount, match hues in paint, and name.

2. Values

Color Values.—The changes from light to dark between the extremes of white and black constitute the value scale of a color.

A convenient number of values, often used and easily distinguished, is *seven*, not including white and black. There are, therefore, *three light* values called *high light*, *light*, *low light*; *three dark* values, called *high dark*, *dark*, *low dark*; and one half way between white and black called *medium* or *middle*, and often spoken of incorrectly as "*half tone*."

The light values are sometimes called "tints" and the dark values "shades," but since these terms are also used in other connections they are not exact or definite.

Each standard pigment has its own value at its brightest intensity as follows:—

Lemon yellow is high light.
Gamboge (yellow) is light.
Orange and green are low light.
Alzarine red and new blue are high dark.
Violet is low dark.

To lighten the value of a color use water; to darken a color add the *complement* to the original color. The *complement* is one of the intermediate hues most opposed to the color itself; for instance, orange is a hot color, green blue is a cold color, so that the blue hues are complementary to the orange hues; the yellows to the violets; the reds to the greens; and *vice versa.*

EXERCISES

Color Values.—1. Make a value scale in graded grays from white to black. Use nine circles or figures, leaving one end figure white, and painting in the other end figure black. Maintain an even and gradual change in value from one figure to another. Label each value with its name.

2. Repeat the graded value scale in any one color. Use seven circles or figures for seven values. Start with the value of the hue used. Label each value with its name.

INTENSITIES

Color Intensities

The changes from bright to neutral color constitute the intensity of a color. In the most neutral tone the result is a colored gray.

A convenient number of intensities often used is five. These are called (1) bright; (2) quarter-tone neutral; (3) half-tone neutral; (4) three-quarters-tone neutral; (5) neutral.

A color is dulled, that is, made neutral, by adding the *complement.* This can be done without changing its value (though the addition of the complement may change its value also, as has been shown). The hue of a dull intensity is more difficult to distinguish than that of a bright intensity.

EXERCISES

Color Intensities.—1. Make an *intensity scale* in five graded tones from bright to neutral according to the following:—

Make three rows of circles or any plane figures, five in a row. In the lowest circle of the center row start with the pure hue of any color. Paint the series neutralizing the color by adding more of the complement to each figure until a colored gray is reached in the top circle. Maintain the dominant color throughout the scale and keep the values the same. In the other rows start with the intermediate hues and try to maintain an equal degree of intensity with those in the first row painted. The result should be fifteen figures of intensities starting with the brightest color and ending with colored gray. These figures may be painted on separate papers and then cut out and mounted in the sequence called for.

2. Collect specimens of neutral colors found in nature, silks, etc., mount, match, and name.

GENERAL COLOR EXERCISES

1. Invent a diagram illustrating the development of the eighteen hues from the three primary colors, and the change in value and intensity of each standard hue.

2. Collect specimens of colors found in nature, materials, etc.; mount, match, and label each specimen with name of hue, degree of value, and intensity.

3. Invent color devices for teaching children:—

(*a*) Making of secondaries from the primary colors.
(*b*) Changes in dark and light. Three values.
(*c*) Changes in hue.
(*d*) Uses of complements.
(*e*) Application of definite color harmonies in design, dress, or decoration.

THE MUNSELL COLOR NOTATION

A color system used in some schools has been developed by Mr. A. H. Munsell of Boston. It is based upon scientific measurement of color vibrations and not upon the pigments in general use. When used it requires special pigments called "Munsell colors." These colors are measured colors of half-tone (middle) intensity, and value, which establish their harmonious relations. The system is based on a decimal system of ten. It has five principal hues: red (R), yellow (Y), green (G), blue (B), and purple (P); five intermediate hues: yellow red (YR), green yellow (GY), blue green (BG), purple blue (PB), and red purple (RP); ten values including white and black, numbered not named: 0 is black, 10 is white, 5 is middle value, etc.; ten degrees of chroma: 1 is neutral and 10 is brightest.

A half-tone, middle value red, is described as follows:—

Hue (red) Value 5
Chroma 5

A light dull green:—

Hue (green) Value 8
Chroma 4

COLOR HARMONIES

Colors used in combination produce either harmony or discord. Harmony depends upon maintaining right relations between hues, values, and intensities of the colors used. For those who have not a cultivated or naturally sensitive color-sense perception, harmony in color combinations is not easily distinguished. However there are a few general suggestions which, when followed, prevent discordant combinations. There are also definite rules, based on a scientific knowledge of color, which produce harmony.

When combining colors consider the following:—

1. *Amount of Color used.*—As a general rule the larger the amount of color used the duller should be its intensity, and *vice versa.* Therefore, large amounts of equally bright colors are discordant.

2. *The Hue of the Colors used.*—Closely related hues are in themselves more harmonious than contrasted hues.

3. *The Value.*—Closely related values are in themselves more harmonious than unrelated values.

4. *The Intensity.*—Neutral colors are in themselves more harmonious than bright colors because they are held together by the common quality *gray.*

Therefore, it is easier to obtain harmony between (1) colors closely related; (2) between those "saturated" with one color, *i.e.*, each containing a certain amount of some one color; and (3) between those in which one color dominates the others. It is possible and more interesting to

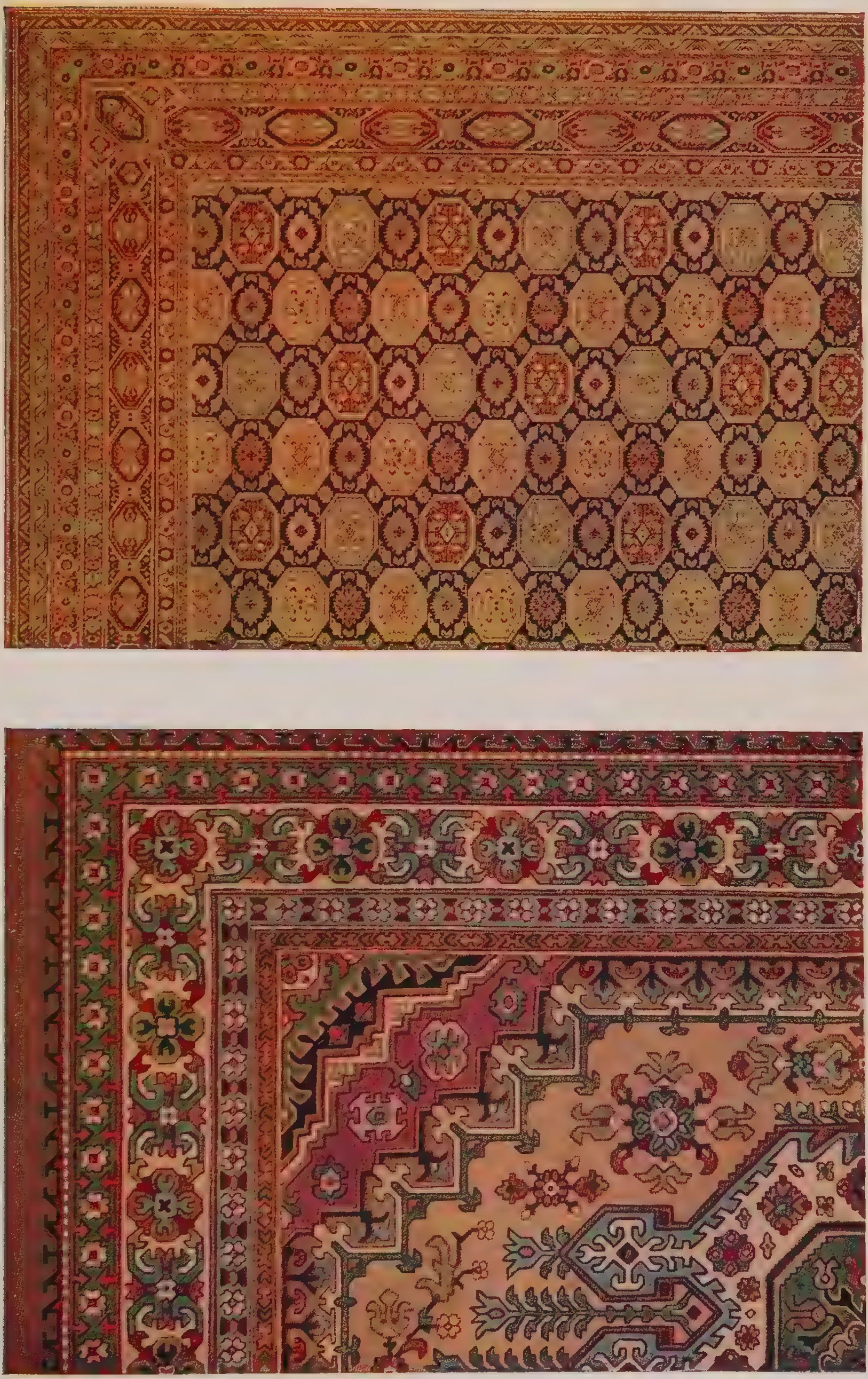


PLATE 42. COLOR HARMONIES

Courtesy of Marshall Field & Company

obtain beautiful harmony between contrasting colors, and between many colors of varying values and intensities. But the more colors, values, and intensities used the more difficult the problem, because their harmony is dependent upon the right adjustment and proper balance of the four elements mentioned.

In some schools certain names are given to color harmonies, as follows:—

1. Contrasted harmony—any hue with black or gray.
2. Dominant harmony—one hue with different values.
3. Analogous harmony—different but closely related hues of same or different values and intensities.
4. Complementary harmony—complementary hues in different intensities, same or different values.

EXERCISES

Color Harmonies

1. Paint a harmony in three oblongs of varying sizes, using three closely related hues of equal value, but three different intensities. Paint the brightest intensity in the smallest oblong.
2. Paint a harmony in three oblongs of various sizes, of two complementary hues, two different intensities, and three different values.
3. Match a color harmony found in nature, in oblongs of various sizes according to the amount of color seen in the specimen.
4. Select a harmony of five colors from a Japanese print.

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